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Electrical World

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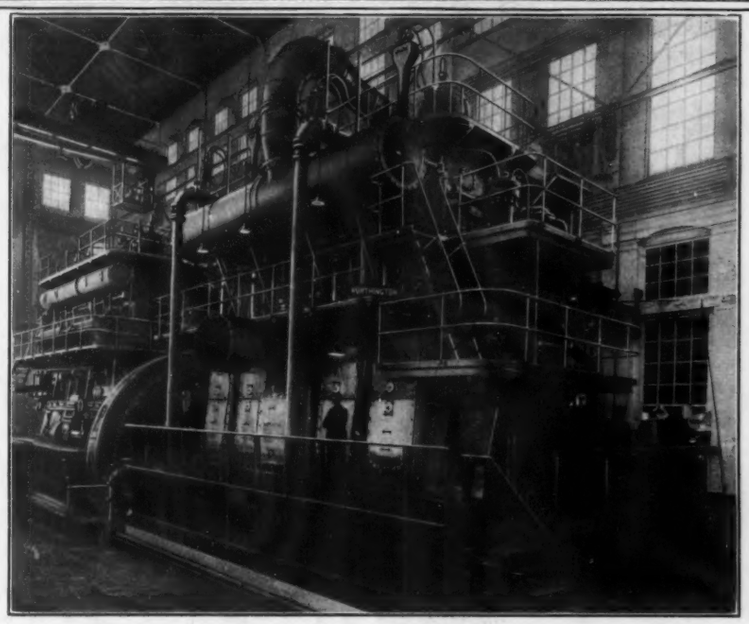

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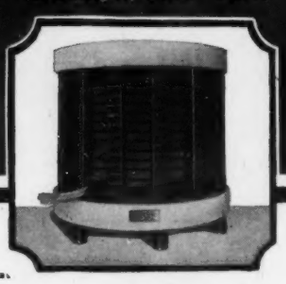

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What
ELECTRICAL WORLD
Subscribers Read

AN EDITOR of the ELECTRICAL WORLD while waiting to see the general manager of a manufacturing plant in New England recently had his attention attracted to a magazine rack on which, among other publications, possibly twelve or fourteen current issues of the ELECTRICAL WORLD were noticeable. Every one of these magazines was well thumbed, but what particularly interested the visitor was the fact that each of the issues had one or more paper markers inserted at different points.

Here the editor recognized a real opportunity to look over the manufacturer's shoulder and see what items attracted his interest. So he settled his chair closer to the rack and began to investigate. A study of the marked articles soon disclosed that in the twelve or fourteen issues represented virtually every section of the paper had at one time or another held the interest of the reader, and the pages bore evidence of having been read by a good many members of the organization.

And so more testimony was added to the record of service which ELECTRICAL WORLD editors are rendering to the industry, an untiring service which takes them into the field—into the central-station plant and into the manufacturer's establishment—to get at first hand the very information which the industry seeks.

Advertising Index—Alphabetical, 96; Classified, 90, 92, 94; Directory of Engineers, 50, 51; Searchlight Section, 52-56

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President, Delta-Star Electric Co.

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Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 89 — *New York, Saturday, June 25, 1927* — NUMBER 26

New Blood Now Available

ENGINEERING colleges are busily engaged in bestowing diplomas upon graduates. Industry is busy with interviews and applications in an attempt to select the best graduates for its purposes. The graduates are set to conquer the world in a few years and are filled with enthusiasm for the adventure of engineering life.

New blood flows into the electrical industry at a most critical time. The industry has become "big business" and requires many trained men to manage its affairs and to help it move forward. The engineering mechanism is the basic raw material which management must wield, and it is to be hoped that business courses and psychological courses in the engineering curricula will enable these young engineers to go forward with an understanding of the human and economic values in business as well as the technical values. The day of one-man industries is past. Co-operation and organization are now essential requirements to industrial success.

There is no fear that many engineering graduates will not meet the business necessities of the electrical industry. The school of hard knocks will give them post-graduate courses, and only the fit will survive. But there is a serious question as to the ability of industry to use these tools to the best advantage. A mass of men come into hit-or-miss positions and enter into a mad and undirected scramble for position. Industry is not yet geared to selective training of college men. It should pick out and develop research men, design men, operating men and all the other varieties according to individual capacities and should have a directed course of training for these men. Part of the waste in industry is a waste of educated man power.

Guy E. Tripp the Man

A GENTLEMAN of great charm and chivalry has been lost to the electrical industry through the death of Guy E. Tripp. Although a self-made man, he showed none of the intolerance, assertiveness and brusqueness betrayed by so many self-made men, but was always the same cordial, sympathetic and generous soul whether he was dealing with bankers and executives or with lesser lights. One did not have to wonder if he was receiving an attentive and sympathetic ear when conversing with General Tripp. There was a ring of sincerity in his voice and an attractiveness in his demeanor which drew men instinctively to him. For that reason those who never came in contact with him in a business way but who saw him and heard him speak, as well as others who had business dealings with him, honored and respected him. To that great company of admirers the news of General Tripp's death will bring a sense of personal sorrow and loss.

General Tripp was not a pioneer or an engineer. He was primarily an accountant; but he used that talent and the Yankee tradition in which he was born to excellent advantage. He was schooled in the public utility field in the well-known house of Stone & Webster of Boston. Responsibility gave him courage and faith in himself, and travel brought him breadth of vision. Naturally, his experience was along financial lines, and it was on the rock of finance that that great captain of industry George Westinghouse came to grief. General Tripp was, therefore, well fitted to follow in Robert Mather's shoes. His task, like that of Mather, was to look after the financial side of the Westinghouse Electric & Manufacturing Company's affairs, and the records of the company indicate that General Tripp's duty was well done. General Tripp was a sincere and great champion of the electrical industry and devoted his talents and time to its furtherance. Few men were more outspoken in its defense and few possessed a clearer or greater vision of its future. His death, therefore, is a severe blow not only to the Westinghouse Electric & Manufacturing Company but to the entire electrical industry. Both have been bereaved; but fortunately the inspiration and example of such a life cannot be smothered by six feet of earth. It lives! and whether we be religious or not, that consolation can and will sustain us.

Unleash the Electric Range and Water Heater

EXAMINATION of the results attained by thirty-two power companies in building the domestic electric range and water-heater load shows that development of this business can be made practicable and profitable for either hydro or steam-generating systems and combination electric and gas utilities as well. Even companies operating in cheap natural-gas territory have found it possible to sell the electric range in considerable quantity on its merits of superior service in the face of the stiffest kind of price competition. Thus belief on the part of a central-station company that local conditions are necessarily different is not an adequate reason for hesitating to make electric cooking available to residential customers both by means of appropriate rates and a suitable commercial organization for the sale, demonstration and servicing of the electric range and water heater.

The fact that many companies have not yet gone after the range and water-heater load on a comprehensive scale is not so much because they think the load costly to serve or that these appliances cannot be sold in their particular communities. Rather it is a state of mind. The central-station industry has become obsessed with the idea that residential use of energy is small at best and that profit to the power company from serving this

class of business is negligible. Power companies have looked upon the domestic user as a "small" customer—they have treated him as such and made him so. Efforts to raise the individual customer's use of energy have been in the nature of trying to get him to lift himself by his own bootstraps. He has been asked to buy more of pretty much the same thing he already has instead of being offered a more complete electric service. Few companies, in their desire to increase the "domestic per-customer" consumption, have been able to visualize this class of business as a potential industrial load. Always the residential user is thought of in terms of fractions instead of whole numbers.

The way to raise this per-customer use of energy is to raise it, not in dribs and dabs of a watt here and another watt there, but in good-sized chunks of whole kilowatts and multiples thereof. The electric range and water heater will do this. Respectively, they will multiply by about four and ten the present average annual consumption of 365 kw.-hr. per customer, thus lifting the domestic-customer load out of the class of the small user with a poor load factor and putting it with the class of industrial electric heating which, it is generally admitted, is most desirable business. Surely, a single customer having a maximum demand of from one to four kilowatts, whose annual consumption is from 2,000 kw.-hr. to 6,000 kw.-hr., with a load factor of 20 to 25 per cent, ought to be attractive. He is, to a number of companies which have proved to their own satisfaction that the electric range and water-heater load has the following distinct commercial and operating advantages: (1) Better load factor; (2) better power factor; (3) reduction in percentage of unaccounted-for distribution losses; (4) increased income from lighting business because of improved distribution; (5) better ratio of gross revenue to invested capital; (6) more complete service to the public; (7) increased gross and net revenue from domestic customers.

It is time for this market to be developed seriously. It is time the utilities changed their state of mind in regard to residence business.

Ready to Go

INTENSIFIED electric service is a conservation measure and selling is a constructive economic activity. Growth and prosperity in any nation and in any industry are denoted by the flow of a full and constant stream of service, materials and products from sources to ultimate users. A stream of dollars flowing into banks is negative and leads to industrial stagnation, but an active flow of products is positive and stimulating. Next to selling sense, the electrical industry needs to know how to keep the stream of products flowing in volume.

By and large, the cost of delivering an electrical device or electric service from the factory to the user is equal to the cost of making the commodity. In other words, mind is more resistant to change than matter. The cost of distribution is the great handicap to the flow of service and products and, next to the problem of selling, needs most to be overcome. Good selling means meeting competition in price as well as in quality. Thus the electrical industry has the job before it clearly outlined. The work has been started and no doubt exists of ultimate accomplishment. The incentives to good selling and to economic distribution are overpowering. The market is enormous, the time is ripe, and all electrical men are ready to sell and to solve the distribution problems encountered in selling.

Speed the Recommended Joint Industry Sales Conference

FEW electrical men will dispute the statement now so commonly heard, that inadequate house wiring presents the major marketing problem confronting the electrical industry today. We have sixteen million homes connected to power lines. Perhaps in 85 per cent of them the sale of appliances, and therefore also of energy, is largely blocked by the lack of outlets available for convenient use. And the question is, what should be done about it?

The industry conference on wiring, which recently published its conclusion on the controversial issue of whether or not the present cost of wiring is restraining the adequate electrical equipment of houses, has made a practical suggestion that calls for action. First, it gave as its judgment that nothing is holding back the development of the industry in so far as house wiring is concerned except the lack of effective selling. Then the conference recommended that the four participating organizations—that is, the National Electric Light Association, the National Electrical Manufacturers' Association, the Electrical Supply Jobbers' Association and the Association of Electragists International—each appoint new delegations consisting of "five outstanding men who they believe will best represent the sales experience and the spirit and the resourcefulness of their several associations, to formulate a program for the promotion of the domestic market for house wiring, electric service and electrical equipment in the homes of America," inviting the co-operation of all other organizations of the electrical industry whose aid and participation should be enlisted. The N.E.M.A. and the N.E.L.A. have voted to take part in such a further conference to set up a broad industry program. The matter waits now for similar action by the jobbers and the electragists.

To some this proposal may seem like the setting up of a new organization to encumber our already highly organized industry. But it is not so. We have these four major associations. We have the other organizations of appliance and lighting equipment manufacturers and dealers, each with a part to play. We have the Society for Electrical Development, now officially tied into the four big associations and providing at last in its directorate an informal council of the industry. We have all this machinery ready to function—eager to help in this big job of getting complete facilities for "doing it electrically" installed quickly in the American home. But we have no prepared plan, no accepted program. The S.E.D. directorate cannot itself lay down such a plan. It will accept the industry's plan, however, and undertake such a part in it as the industry desires. However, such an industry conference of sales executives as is suggested, officially representing the organized industry, would be eminently qualified to set up a comprehensive program and rally the strength of the industry behind it. The jobbers and the electragists will undoubtedly support the recommendation. The other groups of manufacturers and dealers, and the leagues too, will naturally favor so progressive a move-

ment. What is needed most is action. For such a program can be successfully carried through right now as well as five years hence.

Steel-Mill Engineers Face Tasks and Opportunities

STEEL-MILL electrical engineers continue to show their alertness to the responsibilities placed on them 23 years ago, when they formed the Association of Iron and Steel Electrical Engineers. They made their greatest forward step when they convinced company executives of the value of exchanging with competitors practices and data once considered trade secrets. Though it might be difficult to assemble tangible proof, it seems quite obvious that the remarkable strides made in their great industry to bring about economies and increased production through electrification have occurred chiefly since and to the extent that free exchange of practices and experiences has been permitted.

Last week these steel-mill engineers met in their annual convention at Pittsburgh. It was refreshing to observe an absence of the "show-me-or-I'm-not-interested" attitude toward new applications. Several speakers expressed the opinion that every steel-mill engineer should seek out applications of electric heat which may be profitably applied. This attitude was also evidenced by the steady stream of visitors to inspect the 150 or so manufacturers' exhibits. Evidently the steel men have derived such benefits from past applications of electricity that they do not let new ideas go begging for consideration.

While the subject of a symposium to which one whole session was given—namely, anti-friction bearings—sounds like a detail, it was significant of more. Two hundred and fifty men listened to a discussion of the pros and cons of sleeve and anti-fiction bearings with a view toward cutting down starting duties, reducing energy consumption per unit of product, and enabling one machine to handle several operations now requiring time-consuming transferals. An operating opinion, supported by several engineers present, was that sleeve bearings must not be dismissed without serious consideration, because, despite starting friction, they have proved very satisfactory except for low speeds. They entail small inventory cost and can be constructed, applied and interchanged readily. On the other hand, anti-friction bearings, together with developments in synchronous motors, are opening a field for the latter in steel mills, and they have been applied even to rolling mills. Because of the interdependence of synchronous-motor characteristics, engineers should signify which are most important, as improving one characteristic usually sacrifices another.

Probably because they are engaged in a manufacturing business, steel-mill electrical engineers are very sympathetic to manufacturers' problems. They have always co-operated with electrical manufacturers, and now they purpose, in committee deliberation, to decide where sleeve bearings and where anti-friction bearings are preferable, so that motor manufacturers will not be burdened with adapting their products to both classes of bearings. In addition, these engineers are urging standardization of the inside and outside diameter of anti-friction bearings intended for the same duty in order to facilitate interchangeability. Judging from informal comments made during the convention, few steel mills are interested in paralleling their generating plants with those of utility companies for exchange of energy. However, it is understood that such arrangements are being considered in Youngstown, Warren, Toledo, Gary and Birmingham, and both steel mills and power companies will be benefited by expressing their viewpoints on the principles which will make such interchanges mutually advantageous.

Sound Thoughts on Standardization

STANDARDS are commercial aids for buyers and sellers, and they should pay all costs incidental to the making of standards. Professional engineering socities should be retained to make standards whenever technical competency is needed for that purpose, but they should not exercise the executive function or pay the costs of standardization.

These sentiments were expressed by William McClellan in his address to the National Electrical Manufacturers' Association, which was published in the issue of the ELECTRICAL WORLD for June 18. They are based on his broad business experience and intensive study of the standards situation. In his opinion, the orderly and effective making of standards for American industry is essential to the maintenance of commercial pre-eminence. Standardization is a business-holding, business-producing feature of modern industry and is of paramount importance in national industrial life. Prosperity is at stake in the fixation of an effective national standards procedure and policy.

As an executive agency, Mr. McClellan urges that the American Engineering Standards Committee be made the national authority on standards policy and procedure. He urges that it be remodeled so that it will be made effective and authoritative. He recommends that it have a man of exceptional ability as a managing director to insure continuity of policy and action and urges that back of the director there should be a board composed of our best industrial leaders. He calls upon industry executives to give of their thought and time to the big problem confronting industry.

It was to be expected that Mr. McClellan would put his finger on the fundamental thing in the standards situation. His ideas are sound and are based on experience. His plan fits into the national situation splendidly, as proposed or with slight modification, because it provides for authority and for competent personnel. The present A.E.S.C. is not the agency he talks about, and the remodeled A.E.S.C. goes far to conform to the national plan presented by Mr. Morrow in the ELECTRICAL WORLD for May 21. The principles underlying the plans are identical. If experience shows the work to be too heavy for one central board and director, then it would be possible to form subordinate boards with permanent directors for each major industry. These could work with the central board, and the international situation could be handled by another group with a permanent director, this group representing those industries in the remodeled A.E.S.C. interested in international standardization.

The national standards question is going to be settled, and the constructive paper of Mr. McClellan points in the direction along which the best opinion is focused. Action to carry out the principles outlined is certain to result, and American industry should be able soon to go forward freed from a chaotic situation in its standardization program.

Ranges and Water Heaters

for Better Utilization of Service Investment

TO JUSTIFY the heavy capital expenditures for providing adequate domestic distribution systems, customers must be encouraged to use electrical equipment of larger capacity and with higher load factor characteristics than prevail in the average home.

It is variously estimated that the electric range and electric water heater will each tend to raise the individual customer's kilowatt-hour consumption from four to ten times the present national average of only 1 kw.-hr. per day.

Experiences of companies already actively engaged in merchandising efforts afford valuable data concerning methods of sales organization, rates in effect, load and revenue possibilities.

EVERY HOUSE ON THIS STREET IN FRANKLIN, MASS., IS EQUIPPED WITH AN ELECTRIC RANGE

Load Building with the Electric Range and the Water Heater

Thirty-two Central-Station Companies' Experiences in Developing Domestic Electric Cooking and Water Heating—Profits Increase and Capital Costs Decrease with Saturation

FOREMOST among the central-station industry's problems today is to effect a substantial and permanent increase in the kilowatt-hour consumption per residential customer, at the same time lowering rates for this class of service and increasing the gross revenue and profit therefrom. It involves the setting up of follow-on or inducement-type rates that will encourage freer use of energy by customers. Also to be reckoned with is a growing sentiment that favors lower top blocks in residence rates. Heavy capital expenditures have been made and probably will continue to be made in distribution systems. Fixed charges and a return must be earned on this investment.

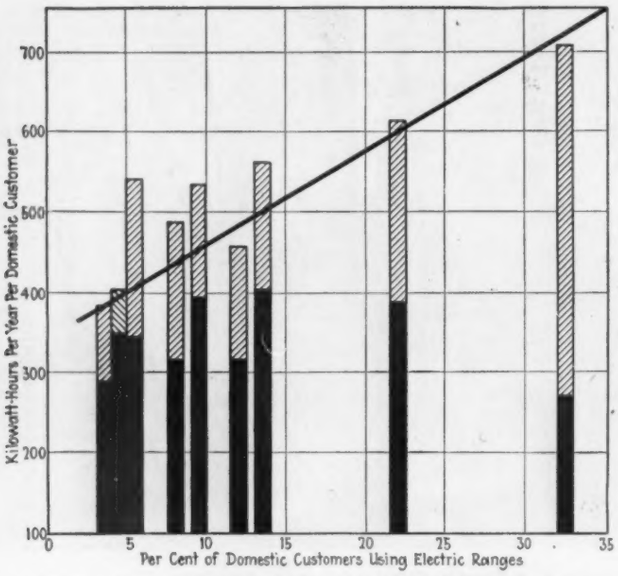
To meet these conditions requires that the domestic customer shall use electrical equipment of much larger capacity and with higher load factor characteristics than prevail in the present average of home-lighting and appliance installations. Of all the household appliances that can be sold to domestic customers the electric range and electric water heater are the heaviest energy consumers. Each will raise the individual customer's kilowatt-hour consumption from four to ten times the present national average of only 1 kw.-hr. per day, or about 365 kw.-hr. per customer per year.

Fortunately for the electrical industry and for the consuming public, there are ample experience and evidence available showing that the electric range and water heater are thoroughly practicable equipment. Desirability of these loads, long a moot question among utility men, was conclusively proved by the exhaustive investigation completed by the N.E.L.A. range survey sub-committee last year. Application of the findings and principles laid down in the report of that committee has caused many utilities to see in the range and water heater a satisfactory and profitable solution of the low domestic consumption problem.

The fact, however, that the domestic electric range is a profitable load to serve and that the utility favors its development by offering a suitable rate is only the first, though very important, step in the commercial program for building this load on the power company's residential circuits. There are many details that should be worked out beforehand, if possible, in order to avoid the pitfalls that usually accompany any new sales undertaking. Experiences of companies that have passed through this first period of introduction afford valuable data as to methods of sales organization, rates in effect, load and revenue possibilities and matters of company policy.

Present Situation and Future Possibilities

To present a cross-section of policies and practices followed by central-station companies in building the electric range and water heater load the ELECTRICAL WORLD has made a survey of the experiences and results obtained by 32 representative electric utilities in all parts of the country. The information collected has been reduced to tabular form to enable easy analysis and comparison by companies about to engage in developing this load as well as those that have already attained a considerable degree of electric range and water heater saturation.



EFFECT OF RANGE USE UPON AVERAGE KILOWATT-HOUR CONSUMED PER DOMESTIC CUSTOMER

The lower part of each column represents the average annual use of energy per customer for lighting and small appliances, whereas the full length of each column shows the average annual consumption per customer for both lighting and ranges. No water-heating load has been included.

A study of the present status of electric range and water heater saturation on the lines of the 32 power companies under consideration affords an interesting composite picture of results obtained under varying conditions of rates, sales effort and policy. There are companies included that have been selling ranges for ten years or more, and there are others that have been "nibbling" at the range load for less than a year. These represent the two extremes and can be easily spotted. There are two companies operating in cheap natural gas territory, two combination gas and electric utilities, six steam-generating, thirteen steam and hydro, eight straight hydro-generating stations and one company that purchases all its energy.

The 32 companies on Dec. 31, 1926, had a total of 2,376,001 domestic customers, of whom 111,306, or 4.71 per cent, were using electric ranges. The energy consumed by these 111,306 ranges in one year is 173,999,000 kw.-hr., for which the 32 utilities receive a total gross revenue of $5,935,200. Reduced to unit figures, each range uses 1,560 kw.-hr., which at a 3.42-cent rate earns $53.23 income per range.

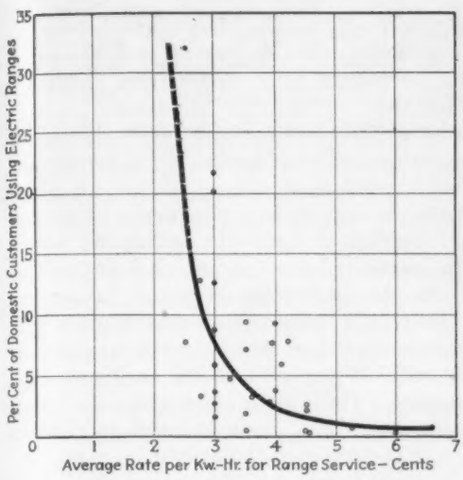
Individually the maximum saturation in a single company's territory was 32 per cent and the minimum 0.2 per cent. Four of the 32 companies had no water heaters on their lines, but the remaining 28 companies, with 2,180,305 residential customers, were serving 23,141 electric water heaters, a saturation of 1.06 per cent. The maximum and minimum saturations in this case were 21.4 and 0.01 per cent respectively.

Individual company estimates of the percentage of domestic customers that are considered bona fide potential prospects varied from 5 to 75 per cent for ranges

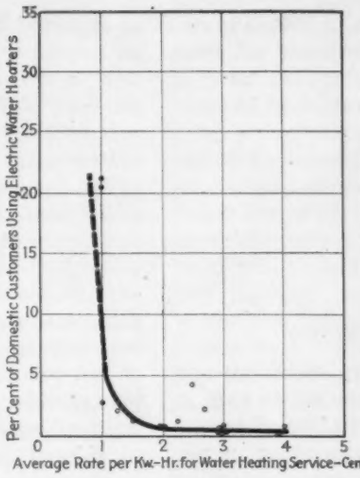
Types of Ranges and Water Heaters Sold, Installation Meth

Company	Electric Ranges					
	Kind of Ranges Sold		Installation Methods			Kw.-Hr. Consumption per Range per Year
	Size (Kw).	Most Popular Type	Cost of Connection ($)	Paid by	Wiring Done by	
1	6.5	Automatic 16 in. oven	45—75 city, 25 rural	Included in selling price.	Contractor-dealers now.	1,500
2	6.5	Automatic 16 in. oven	30	Included in selling price.	Contractors and cent. station.	2,200
3	7.0	Automatic temp. control	40	Added to price of range.	Central station.	1,644
4	7.5	Automatic temp. control	20	Added to price of range.	Contractors and cent. station.	1,700
5	7.5	Automatic temp. control	65	Customer.	Contractor.	1,500
6	7.5	Automatic temp. control	38	Added to price of range.	Contractor.	1,815
7	7.5	Automatic temp. control	60	Customer.	Contractor.	1,500
8	7.5	Automatic temp. control	72	Customer.	Contractor.	1,800
9	7.5	Automatic temp. control	90	Customer.	Contractor.	1,500
10	6.5	Automatic temp. control	45–75	Customer.	Contractor.	1,800
11	7.5	Automatic temp. control	60	Customer.	Contractor.	1,750
12	7.5	Automatic temp. control	60	Customer.	Contractor.	1,800
13	7.5	Miscellaneous	Cost	Customer.	Contractor.	2,564
14	8.0	Automatic temp. control	Labor and material.	Central station.	Contractor.	1,800
15	7.5	Automatic temp. control	50	Customer.	Central station.	1,800
16	7.0	Automatic temp. control	65–80	$35 allowance paid by cent. station.	Contractor*	1,800
17	7.0	Automatic temp. control	75	Customer.	Contractor.	1,600
18	.....	Miscellaneous	60–75–125	Customer.	Contractor.	1,800
19	7.5	Automatic temp. control	50	Added to selling price.	Contractor.	1,800
20	6–8	Automatic temp. control	80 (average)	$25 allowance paid by cent. station.	Contractor.	1,650
21	7.0	Non-automatic	40	Customer.	Central station.	1,800
22	5.5–9.2	Miscellaneous	60	Customer.	Contractor.	1,750
23	6.5–8	Automatic temp. control	55	Included in price of range.	Contractor.	1,800
24	6.5–8	Automatic temp. control	26	Included in price of range.	Contractor.	1,500
25	6.5–8	Automatic temp. control	35	Included in price of range.	Contractor.	1,500
26	6.5–8	Automatic temp. control	35	Included in price of range.	Contractor.	1,500
27	6.5–8	Automatic temp. control	35	Included in price of range.	Contractor.	1,500
28	6.5–8	Automatic temp. control	35	Included in price of range.	Contractor.	1,500
29	6.5–8	Automatic temp. control	35–40	Included in price of range.	Contractor.	1,500
30	6.5–8	Automatic temp. control	40	Included in price of range.	Contractor.	1,500
31	6.5–8	Automatic temp. control	60	Included in price of range.	Contractor.	1,500
32	6.5–8	Automatic temp. control	50	Included in price of range.	Contractor.	1,500

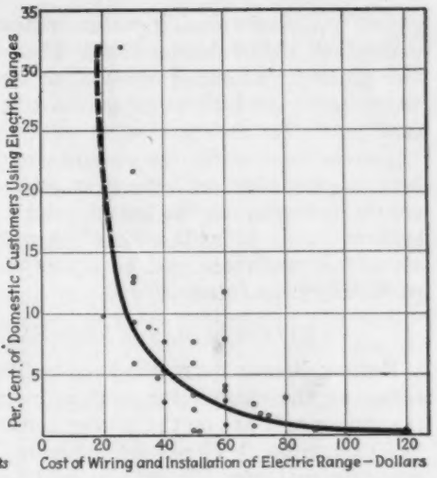
*Ranges installed by central station for $32.50 total. †Continuous—Automatic ‡Intermittent—Manual.



RELATION OF COST OF ENERGY TO RANGE SATURATION



RELATION OF COST OF ENERGY TO USE OF ELECTRIC WATER HEATERS



HIGH INSTALLATION COSTS MAY RETARD RANGE SALES

and from 1 to 40 per cent for water heaters. It is significant to note here that those companies that already have a relatively high saturation are the most optimistic as to future possibilities, whereas those with low density are more timorous in visualizing their markets. It is an easy and safe conclusion to draw from this condition that as saturation increases the market broadens, so that the company which now has 32 per cent of its customers using ranges and expects to sell 75 per cent will, when it reaches the 50 per cent mark, set its goal nearer 100 per cent.

The 32 companies during 1926 sold a total of 27,961 electric ranges, or 1.18 per cent of their customers, and 28 of these companies estimate that in the next five to ten years they will sell a total of 579,700 ranges, representing 26.8 of the present customers. Of the 111,306 electric ranges on the lines of these companies 25.2 per cent were sold during the last year. Twenty-six com-

Methods and Annual Energy Consumption

Electric Water Heaters						
Kind of Water Heaters Sold		Installation Methods			Kw.-Hr. Consumption per Water Heater per Year	Company
Size (Kw.)	Most Popular Type	Cost of Connection	Paid by	Wiring Done by		
3.0	Automatic	Labor and material	Customer	Contractor	2,500	1
5.0	Bayonet	$20	Customer	Central station	3,000	2
5.0	Bayonet	Labor and material	Customer	Central station	3,000	3
3.0	Circulating and bayonet	Labor and material	Customer	Contractor and central station	2,500	4
2.0	Circulating	Labor and material	Customer	Contractor	3,000	5
.....	.....	.....	.....	.....	.....	6
.....	.....	.....	.....	.....	.....	7
3.0	Bayonet	Labor and material	Customer	Contractor	4,200	8
3.0	Circulating	$55	Customer	Contractor	2,000	9
5.0	Circulating	$20–$40	Customer	Contractor	2,200	10
.....	.....	.....	.....	.....	.....	11
3.0	Circulating	$10	Customer	Contractor	2,000	12
4.8	Bayonet	Cost	Customer	Contractor	3,000	13
3.0	Circulating	Labor and material	Central station	Contractor	2,500	14
.....	.....	.....	.....	.....	.....	15
.....	.....	.....	.....	.....	.....	16
.....	.....	.....	.....	.....	.....	17
.....	.....	.....	.....	.....	.....	18
5.0	Circulating	Labor and material	Customer	Contractor	3,600	19
3.0	Circulating	Labor and material	Customer	Contractor	3,000	20
5.0	Non-automatic	Labor and material	Customer	Central station	3,000	21
3.0	Non-automatic	$40–$50	Customer	Contractor	3,000	22
.....	.....	.....	.....	.....	.....	23
1.0 (average)	Clamp on	$9	Customer	Contractor	5,086	24
0.75 (av.)	Clamp on	$10	Customer	Contractor	6,000	25
1.0	Circulating	$26	Customer	Contractor	No data	26
3.0	Circulating	Labor and material	Customer	Contractor	No data	27
						28
0.6–1.5	Insert, circulating, clamp on	$12.50 average	Customer	Contractor	.....	29
						30
2.5–6	Circulating—87%	.....	Customer	Contractor	6,900†	31
					2,520‡	32

panies sold 8,280 electric water heaters in 1926 and expect to sell 10,500 during 1927. They estimate the present market (among 1,588,405 customers) at 246,150 water heaters, which would give a saturation of 15.5 per cent.

The foregoing figures summarize briefly what has been accomplished by a group of 32 central-station companies in developing the use of electric ranges and water heaters and indicate what these companies conservatively estimate can be accomplished in the comparatively near future.

Effect of Range Load Saturation

Before discussing methods of selling, installing and servicing the electric range it is interesting to look at the influence it has on the energy consumption of domestic customers. The kilowatt-hour consumption per domestic customer for lighting and for range operation as reported by nine companies is shown graphically in an accompanying chart. The degree of range saturation on the nine companies' lines varies from about 3.3 per cent to 32 per cent.

It will be seen that the mean average consumption per customer for lighting and small appliances is something under the national average of about 365 kw.-hr. The addition of the range load, even in the homes of a comparatively small portion of domestic customers, has a marked effect in increasing the average consumption of all customers. As the percentage of range saturation increases, the over-all kilowatt-hour consumption per customer increases rapidly, as will be noted in the case of the company with 32 per cent of its residence customers using ranges. These data cover the entire systems of each company, but were isolated territories considered an even better showing would be made; as in the case of a small town of 6,000, where the range

Methods Used in Selling

Company	Ranges Sold By	Sales Organization		Range Salesmen Employed by Utility	
		General Plan	Campaign Summer or Continuous	Number	Special or Part Time
1	Central station.	Special offers—time payments.	Two campaigns.	Regular sales force	Part time of appliance salesmen.
2	Central station.	Special drives—time payments.	Two campaigns, spring and summer	Regular sales force	No special range salesmen.
3	Central station.	Territory divided under four supervisors.	Continuous with one campaign.	12	Special range and water heater salesmen.
4	Central station.	General sales organization time payments, continuous.	One 6-week campaign.	Regular sales force	Part time.
5	Electrical dealers.	Central-station does not sell appliances.	Continuous.	.....	.....
6	Central station.	Year-round selling with one advertised cooking school.	Continuous.	3	Special.
7	Central station and dealers.	Ranges sold from display rooms only.	Continuous.	.....	Regular men.
8	Central station	Year-round selling by appl. salesmen.	Continuous.	25	Part time.
9	Central station.	Sold by appliance dept.	Continuous.	.....	Part time.
10	Central station.	Sold by appliance dept.	Continuous.	2	Part time.
11	Central station.	Sold by appliance dept.	Continuous.	1	Part time.
12	Central station.	Sold by appliance dept.	Summer.	2	Part time.
13	Central station.	Sold by appliance dept.	Continuous.	1	Part time.
14	Central station.	Sold by appliance dept.	Continuous.	8	Part time.
15	Central station.	Sold by appliance dept.	Continuous.	7	Part time.
16	Central station.	Sold by appliance dept.	Continuous.	.....	Part time.
17	Central station.	Sold by appliance dept.	Continuous.	.....	Part time.
18	Contractor-dealers.	None	.....	.....	.....
19	Central station.	Special range dept. being organized.	Continuous.	2	Special.
20	Central station.	Special range dept. being organized.	Continuous.	2	Special.
21	Central station.	Sold by appliance dept.	Continuous.	.....	Part time.
22	Central station and dealers.	Sold by appliance dept.	Continuous.	4	Part time.
23	Central station and dealers.	Sold by appliance dept.	Continuous.	.....	Part time.
24	Central station.	Special division of mdse. dept.	Continuous and two campaigns, spring and fall	17	Special range salesmen.
25	Central station.	Special division of mdse. dept.		8	Special range salesmen.
26	Central station.	Special division of mdse. dept.		9	Special range salesmen.
27	Central station.	Special division of mdse. dept.		.....	Special range salesmen.
28	Central station.	Special division of mdse. dept.		.....	Special range salesmen.
29	Central station.	Special division of mdse. dept.		35	Special range salesmen.
30	Central station.	Special division of mdse. dept.		.....	Special range salesmen.
31	Central station.	Special division of mdse. dept.		.....	Special range salesmen.
32	Central station.	Special division of mdse. dept.		.....	Special range salesmen.

*(Note:—Salesmen's compensation closely approximating 10-12% commission is used by most of companies 25 to 32.)

saturation is 31.8 per cent, the average use per domestic customer is 968 kw.-hr. per year for lights, appliances and ranges, water heating excluded.

CAPITAL INVESTMENT TO SERVE RANGE

Another important feature attendant upon yearly increases in range saturation is its effect in reducing the investment per range in transformer and local distribution system facilities as shown in a chart covering a period of three years. This particular company in 1923 was serving about 600 range customers when the cost of connecting each new range customer was $60. At the end of 1926 there were 2,040 ranges on the company's lines and the connection cost had been reduced to $55 per range.

A still further advantage of a growing percentage of range users on a company's system is its very marked tendency to decrease the system investment necessary to serve the individual range. Not all companies were able to segregate their capital costs per kilowatt of range demand. Nine companies that have made a careful study of system costs to serve the range load have agreed upon an average cost of $75 to provide service for one electric range customer. This is approximately equivalent to $100 per kilowatt of range demand. These companies now have a fairly high degree of saturation, but expect these costs to be still lower as more ranges are put in use. It is interesting to contrast this figure with that of a company having a range saturation of only 0.41 per cent, where the capital cost per kilowatt of range demand is given as $355. Here again it is apparent that companies with limited experience in serving this load are inclined to place a heavy burden of capital investment against the individual range customer.

The low average maximum demand per range and

lectric Ranges and Water Heaters

thod of Salesmen's Compensation*	Manufacturer's Assistance in Selling	Demonstrations and Cooking Schools	No. Ranges Sold per Year per Salesman	
			Special Range Men	Part Time Men
100 sal. + 5% on first $2,000 sales and 10% over $2,000.	Four factory representatives.	Three demonstrators used with periodic cooking schools.	.....	.....
65 sal. + 10% com.	Mfrs. specialists furnished during campaigns.	Cooking schools during campaigns-demonstrations year round.	.....	.....
50 sal. + 10% com.	Mfrs. specialists furnished during campaigns.	Home economist visits range users. Range demonstrations held weekly.	75	.....
75 sal. + 5% on ranges, 10% on sales less than $50.	Mfrs. specialists used during campaign.	Demonstrations and cooking schools.	.....	.....
.....	.....	.....	.....	.....
Drawing acc., 15% com. + bonuses.	Cost of demonstration and cooking schools shared equally by manufacturer and utility.	Once each year cooking school is held.	97	.....
Straight salary.	Furnishes broadsides, cuts, etc.	Has opened demonstration room.	.....	.....
$25—$40 weekly salary.	Mfrs. furnish adv. material and assist with demonstrations.	Yes, found very helpful as educational means.	.....	16
Straight salary.	Not used.	None.	.....	.....
$30 per week + 10% com.	Mfrs. furnish adv. material and demonstrators.	Occasional demonstrations.	.....	27
Straight salary.	Mfrs. furnish adv. material.	Demonstrator employed continuously.	.....	60
Straight salary.	Mfrs. furnish adv. material.	Floor display and office demonstrations.	.....	14
Drawing acct. 12% com.	Mfrs. furnish adv. material, window displays—help with demonstrations.	Three-day cooking school.	.....	60
10% com. on range sales.	Mfrs. furnish adv. material and some demonstration help.	Limited amount of demonstrating done.	.....	13
Straight salary.	Mfr. furnishes adv. helps.	Office demonstrations held occasionally.	.....	3
Sal. + 12½% com.	Factory furnishes demonstrator, and publicity material.	Demonstrations and cooking schools very effective.	.....	.....
.....	.....	.....	.....	.....
.....	Not enough interest to use.	.....	.....	.....
Sal. $150 + $10 per range.	Assist in cooking schools and demonstrations.	Cooking schools once a month.	87	.....
Sal. + com.	Furnish adv. material and demonstrators as requested.	Cooking schools—demonstrations used very effectively.	118	.....
Sal. + 10% com.	Range mfrs. adv. and demonstration very good.	Cooking schools—demonstrations found very effective.	.....	.....
Straight salary.	Mfrs. furnish demonstrator.	Only one demonstration put on so far.	.....	6
$20 per week plus 5%.	Not used as yet.	Considering.	.....	.....
10% com. also $125 + com.	Mfrs. furnish special men, demonstrators and assist in putting on campaigns.†	Demonstrations and cooking schools are used extensively and produce results.†	80	.....
.....	.....	.....	.....	.....
.....	.....	.....	137	.....
.....	.....	.....	200	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	174	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....

† Similar methods and experiences for companies 25-32.

Maximum Demand and Investment Costs to Serve the Electric Range and Water Heater

Company	Electric Ranges			Electric Water Heaters				Company	Electric Ranges			Electric Water Heaters			
	Maximum Demand per Range (Kw.)	No. Ranges Served from One 15-Kw. Transformer	Capital Cost per Kw. of Range Demand	Maximum Demand per Water Heater (Kw.)	No. Water Heaters Served from One 15-Kw. Transformer	Capital Cost per Kw. of Water Heater Demand	No. Ranges and Water Heaters Served from One 15-Kw. Transformer		Maximum Demand per Range (Kw.)	No. Ranges Served from One 15-Kw. Transformer	Capital Cost per Kw. of Range Demand	Maximum Demand per Water Heater (Kw.)	No. Water Heater. Served from One 15-Kw. Transformer	Capital Cost per Kw. of Water Heater Demand	No. Ranges and Water Heaters Served from One 15-Kw. Transformer
1	1.50	9	.....	2.	.....	.....	.....	17	.....	.....	.....	.....	.....	.....	.....
2	1.50	10	$115	.....	.....	.....	.....	18	.....	.....	.....	.....	.....	.....	.....
3	1.50	10	55(*a*)	.....	.....	.....	.....	19	3.00	.....	.....	.....	.....	.....	.....
4	1.25	11	.....	.....	.....	.....	.....	20	1.00	15	243	.....	.....	$243	No (*e*)
5	5.00	4	150(*b*)	2.	4(*c*)	.....	4 ea.	21	5.00	4	.....	5.	.....	.....	.....
6	2.50	7	175(*b*)	.....	.....	.....	.....	22	.....	.....	.....	.....	.....	.....	.....
7	1.50	10	250(*b*)	.....	.....	.....	.....	23	5.00	.....	.....	.....	.....	.....	.....
8	.....	.....	.....	.....	.....	.....	.....	24							
9	5.00	.....	355	.....	.....	.....	.....	25							
10	3.00	7	.....	5.	7	.....	7	26							
11	.....	.....	.....	.....	.....	.....	.....	27							
12	3.00	.....	.....	.....	.....	.....	.....	28	0.86	10	100	0.7	10	65	10
13	6.50	6	.....	4	6	.....	75 kw.(*d*)	29							
14	.....	.....	.....	.....	.....	.....	.....	30							
15	.....	.....	.....	.....	.....	.....	.....	31							
16	4.00	.....	.....	.....	.....	.....	.....	32							

(*a*) Not including general station. (*b*) Per range. (*c*) With range. (*d*) Range and water heaters served from a 25-kw. transformer. (*e*) Combinations.

Average Rates and Methods of Metering

Company	Electric Ranges		
	Type of Rate for Range Service	Special or Regular Rate for Range Service	Is Separate Meter Used
1	$1.50—$2 minimum, 3c. net per kw.-hr.—also, 12c. first 10, 10c. next 20 and 4c. over 30 kw.-hr.	Special—Regular	Yes—No
2	$3 demand charge plus 3.5c. per kw.-hr. for first 150 kw.-hr., 2.5c. for all excess	Special	Yes
3	First 40 kw.-hr. 9c. excess @ 3c.—5% discount, 4c. per kw.-hr. less 5% discount	Regular—Special	No—Yes
4	First 50 kw.-hr. @ 4c. next 50 kw.-hr. @ 3½c. over 100 kw.-hr. @ 3c.	Special	Yes
5	3c. per kw.-hr	Regular	No
6	First 10 kw.-hr. 8c., next 10 @ 6.5c., next 40 @ 5c., next 40 @ 3c., all over 100 kw.-hr. @ 2.5c.	Regular	No
7	10c. per kw.-hr. first 3 kw.-hr. per room, 4c. for all excess, less 10% discount	Regular	No
8	First 20 kw.-hr. @ 8.5c., excess @ 3c	Special	Yes
9	Service charge $54 per year + 1½c. per kw.-hr.	Special	Yes
10	2.7c. net per kw.-hr.	Special	Yes
11	10c. first 12 kw.-hr., 9.5c. next 12c. next kw.-hr. 3c. all excess	Special	Yes
12	8c. first 25 kw.-hr., excess @ 3c. net	Special	Yes
13	First 50 kw.-hr. @ 5c., next 100 kw.-hr. @ 2c., all excess @ 1c.	Regular	No
14	3c. per kw.-hr	Special	Yes
15	Room rate: 3.5 kw.-hr. @ 10.5c., next 5 kw.-hr. @ 8c., over 8.5 kw.-hr. per room @ 4c.	Regular	No
16	Area and demand charge + energy @ 3c. per kw.-hr.	Regular	No
17	25 kw.-hr. @ 12c., 50 kw.-hr. @ 6c., all excess @ 3c.*	Regular	No
18	Demand charge $6 per kw. demand per year, + 4c. per kw.-hr	Special	Yes
19	Two part rate: 8c. per 100 sq.ft. area + 4c. per kw.-hr	Regular	No
20	$2 per month + 8c. per 100 sq.ft. floor area energy @ 3c. per kw.-hr.	Regular	No
21	$2 minimum 3c. per kw.-hr.	Special	Yes
22	First 10 kw.-hr. @ 7c., excess @ 4c.	Special	Yes
23	First 10 kw.-hr. per kw., maximum demand @ 10c., next 90 @ 4c., excess @ 3c	Special	Yes
24	First 50 kw.-hr. @ 3c., next 50 @ 2.5c., all excess @ 2c. net	Special	Yes
25	First 32 kw.-hr. @ 5.5c., all excess @ 3c	Regular	No
26	$1 first 13 kw.-hr., 7c. per kw.-hr., second block, 3c., next 50 kw.-hr., 2c. per kw.-hr. all excess	Regular	No
27	3c. per kw.-hr	Special	Yes
28	4c. per kw.-hr., $2 per month minimum	Special	Yes
29	First 40 kw.-hr. @ 5.5c., next 200 kw.-hr. @ 2c., all excess @ 1c. Also 3c. per kw.-hr.	Regular†	No—Yes
30	First 30 kw.-hr. @ 8c., next 120 kw.-hr. @ 4c., all excess @ 1.5c.	Regular	No
31	First kw.-hr. @ 9c., next 150 kw.-hr. @ 3.5c., excess @ 2c.	Special	No
32	First 21 kw.-hr. @ 5.6c., next 150 kw.-hr. @ 3c., all excess @ 2c	Special	No

*Inducement type ratio now being considered.
†3c. rate is special
‡But not on auto. water heaters.
††Between range oven and heater.
**Approximate.

the desirable diversity factor characteristics as shown by the N.E.L.A. range survey committee do not warrant charging against the range a capital investment based either on demand of the individual installation or the undiversified connected load.

RATES TO ENCOURAGE USE

The degree of range and water-heater saturation attained in a company's territory bears a very close relation to the average rate offered for this service. Two diagrams, one for ranges and one for water heaters, have been prepared showing the percentage of customers using these appliances and the corresponding average rates in effect. For range service it will be seen that use increases very rapidly with a rate of 4.5 cents or less and that a rate of between 3 and 4 cents is most generally offered. Eighteen of the 32 companies have range rates within these limits.

For water heating the rate must be well under 3 cents to encourage any great volume of this business. At a 2-cent rate or less the number of customers using heaters increases rapidly and at 1½ and 1 cent a very free use of this service is found. Much of the water-heating load on the lines of utility companies in the Northwest has been taken on a flat rate basis and little data are available on the kilowatt-hour consumption or probable cost per kilowatt-hour.

A majority of the companies, 17, offer a special rate for range service and install a separate meter. Twelve companies, however, have designed their domestic rates so that the range and lighting go on the same meter, and three companies have two or more rates upon which the range may be used at the option of the customer. In all cases where a special cooking rate is in effect a separate meter is installed.

For the most part companies are offering the same rate for water heating as for range service. One company in the East has a 2-cent block in its range rate for energy consumption from 200 kw.-hr. to 600 kw.-hr. per month, with all excess at 1 cent, which has encouraged a very considerable amount of water-heater business. The company with the highest degree of water-heater saturation (21.4 per cent) has a special straight line rate for water heating of 1 cent per kilowatt-hour with a separate meter. Only four companies with a meter rate for water heating use a double-throw switch between the range and water heater so that both cannot be operated at the same time. Three of the four companies offering a flat rate for water heating require the installation of such a switch, one company placing it between the range oven only and the heater.

Any company that decides to build an electric range load should make up its mind that the way to sell the electric range is to sell it. A definite sales policy must

Electric Ranges and Water Heaters

Average Kw.-Hr. Rate for Range Service, Cents	Electric Water Heaters				Company
	Type of Rate for Water Heating	Is Separate Meter Used	Average Kw.-Hr. Rate for Water Heating, Cents	Is Manual or Auto Throwover Switch Used	
3.0—4.0	Range rate	Range meter	3.0 —4.0	Manual‡	1
4.1	.....	.....	.....	Yes	2
3.95—3.8	Range rate	Range meter	3.95—3.8	Not as yet	3
3.5	Range rate	Range meter	3.0	No	4
3.0	Range rate	No	3.0	No	5
3.25	Range rate	No	.....	.....	6
4.0	.....	.....	.....	.....	7
3.5	Range rate	.....	3.0	No	8
3.5	Range rate	.....	.....	Yes	9
2.7	Range rate	.....	2.7	No	10
4.2	.....	.....	.....	.....	11
3.9	Range rate	.....	.....	No	12
2.5	Range rate	.....	2.5	No	13
3.0	Range rate	.....	3.0	Yes	14
4.5	Range rate	.....	.....	No	15
4.5	Range rate	.....	.....	No	16
5.25	Range rate	.....	.....	No	17
6.0	.....	.....	.....	.....	18
4.5	Range rate	.....	.....	No	19
3.6	Range rate	.....	.....	No	20
3.0	Over 200 kw.-hr. @ 2c.—Over 600 kw.-hr. @ 1c. per kw.-hr. (per month)	Range meter	2.25	No	21
6.6	Range rate	Range meter	.....	No	22
4.5	Range rate	Range meter	.....	No	23
2.5	1c. per kw.-hr.	Yes	1.0	No	24
3.0	$2 per month flat rate for 600 watt heaters—$3 per kw. flat rate per month for heater over 1 kw.	Yes	1.0	Yes††	25
2.75	$3.50 per kw. per month flat rate	Yes	1.0	Yes	26
3.0	Range rate	.....	3.0	.....	27
4.0	$3.25 per kw. per month flat rate	.....	1.25—1.50**	Yes	28
3.0	$4 per kw. per month flat rate	.....	1.25—1.50**	No	29
3.5	Range rate	.....	1.5	.....	30
3.0	Range rate	.....	2.0	.....	31
2.75	Range rate	.....	2.0	.....	32

be set up, provision must be made for wiring, installation and servicing. The company's residential territory should be mapped and studied in order that initial sales effort will be most productive in placing ranges in representative homes where they will serve to stimulate interest of other prospective users.

Sale of the electric range is the central-station company's own particular responsibility. In all but one of the 32 companies represented in the accompanying tabulations the power company is either the sole or the principal selling agency for electric cooking. In the one locality where ranges are sold only by dealers, those dealers state that they would welcome the local utility's participation in the sale of the electric range. Under existing conditions it is impossible to arouse consumer interest without the aid of the power company, installation costs are felt to be excessive and the contractor-dealers cannot afford to offer long-time payments. In other localities dealer interest in development of the electric range business is confined almost entirely to the amount of wiring contingent upon the installation and connection of this appliance. The local utility assisted by the range manufacturer or his representative carries the major burden of selling.

Advantage of Special Range Salesmen

Power companies' sales organizations and programs for selling the electric range vary considerably, depending upon how intensely the individual company is going after this business. In nearly all cases range selling is a part of the company's appliance merchandising department's work, but the most successful operations are those where special attention is given to range business either by an electric cooking department or by a force of special range salesmen who devote their entire attention to it. A comparison of the results obtained by eight companies using special range salesmen with eight companies using their regular salesmen on a part-time

Present Status of Electric Range and Water Heater Load, 1926 Sales and 1927 Sales Quotas for 32 Central Station Companies

	Electric Ranges							Electric Water Heaters					
Company	No. of Domestic Customers	No. of Electric Ranges on Lines Dec. 31, 1926	Per Cent of Domestic Customers Using Electric Ranges	No. of Electric Ranges Sold in 1926	Electric Range Sales Quota for 1927	Per Cent of Domestic Customers Considered Range Prospects	Probable Number of Range Users in Territory	No. of Electric Water Heaters on Lines Dec. 31, 1926	Per Cent of Domestic Customers Using Electric Water Heaters	No. Electric Water Heaters Sold in 1926	Water Heater Sales Quota for 1927	Per Cent of Domestic Customers Considered Water Heater Prospects	Probable No. Water Heater Users in Territory
1[1,4]	124,074	1,950	1.56	1,500	1,500	10	12,400	150	0.12	150	500	10	12,400
2[4]	46,294	2,751	5.94	1,483	2,000	25	11,500	375	0.81	238	500	25	11,500
3[4]	63,204	4,800	7.59	903	1,350	30	19,000	274	0.43	143	400	30	19,000
4[4]	42,500	4,025	9.47	1,504	1,500	50	21,250	333	0.78	120	200	20	8,500
5[2,3]	2,700*	550	20.19	93	.....	50	1,350	12	0.45	5	.....	25	675
6[2,3]	45,000	2,100	4.67	290	1,815	25	11,250	.....	.....	.....	.....	.....	.....
7[3]	385,000	15,000	3.89	1,750	2,300	25 to 50	96,000	.....	.....	.....	.....	.....	.....
8[3]	218,000	4,000	1.83	405	675	5	10,900	500	0.23	50	60	2	4,360
9[3,6]	75,100	305	0.41	26	100	15	10,260	50	0.06	.....	.....	.....	.....
10[3]	3,500	409	11.69	54	50	25	875	76	2.17	13	20	10	350
11[6]	3,800	300	7.89	60	60	40	1,520	.....	.....	.....	.....	.....	.....
12[3]	9,000	250	2.78	27	50	10	900	10	0.01	10	10	1	90
13[5]	4,975	388	7.60	60	100	20	1,000	211	4.23	5	12	10	500
14[5]	14,000	800	5.71	105	150	20	2,800	100	0.71	25	50	10	1,400
15[3]	42,350	150	0.35	25	25	.....	.....	25	0.06	2	2	.....	.....
16[5]	20,000	500	2.50	99	250	50	10,000	25	0.01	8	12	10	2,000
17[4]	15,000	89	0.59	6	12	.....	.....	100	0.66	12	25	.....	.....
18[4]	38,346	100	0.26	15	15	.....	.....	.....	.....	.....	.....	.....	.....
19[4,6]	50,000	1,100	2.20	174	500	5–10	5,000	50	0.10	13	20	.....	.....
20[4]	65,450	2,050	3.13	236	600	20, 5 yrs.	13,100	125	0.20	8	25	5	3,275
21[5]	49,565	1,346	2.72	216	244	5	2,500	635	1.28	162	175	5	2,500
22[4]	50,000	400	0.80	24	24	.....	.....	38	0.07	4	24	.....	.....
23[4,6]	12,500	25	0.20	10	50	5	625	3	0.02	1	.....	.....	.....
24[5]	23,250	8,440	32.00	1,365	1,000	75	18,000	4,990	21.40	715	715	40	9,300
25[5]	24,261	5,269	21.70	1,100	1,200	50	12,130	5,109	20.60	1,064	1,000	30	7,300
26[4]	65,068	8,394	12.90	1,800	2,500	50	32,500	1,790	2.75	313	500	20	15,000
27[4]	70,277	8,855	12.60	1,249	1,915	50	35,100	100	0.14	.....	500	.....	.....
28[5]	35,190	3,340	9.50	479	600	50	17,500	710	2.02	326	400	20	7,000
29[5]	102,000	8,875	8.70	6,105	6,000	40	40,800	1,950	1.91	1,500	1,500	20	20,400
30[4]	48,160	2,600	5.40	687	1,000	35	17,840	570	1.18	667	750	15–20	9,600
31[1,5]	335,000	12,495	3.70	3,507	3,000	30	100,500	2,720	0.81	1,452	1,500	15–20	67,000
32[4]	292,437	9,650	3.30	2,604	3,000	25	73,100	2,110	0.72	1,274	1,600	15	44,000
Totals	2,376,001	111,306	4.71	27,961	33,585	26.8†	579,700	23,141	1.06‡	8,280	10,500	15.5°	246,150

[1] Combination gas and electric company.
[2] Natural gas territory.
[3] Energy generated in steam plants.
[4] Energy generated in both steam and hydro plants.
[5] Energy generated in hydro plants.
[6] Energy purchased.
* Rural customers only.
† Based on estimates of 28 companies reporting.
‡ Based on data from 28 companies.
° Based on 21 companies' estimates.

basis is enlightening. Eighty-eight special range salesmen sold 11,973, or 136 ranges per salesman, during the year 1926, whereas 50 part-time salesmen sold altogether 760 ranges, or only 15 per man for the entire year.

Nearly all companies endeavor to conduct their range sales program on a continuous year-around basis, but this needs some qualification, as one or two campaigns are usually carried on to stimulate sales and build up a prospect list. The practice of holding one campaign in the spring and another in the late summer or early fall has been found to work out very well. It offers an opportunity to hold cooking schools and special demonstrations and to cash in on attractive terms or special inducements that are limited to the duration of the campaign. The manufacturers' sales assistance and specialists on ranges and water heaters can be used to best advantage to the power company and economy to the manufacturer during a campaign period.

The experience of companies following this practice shows that about half of the ranges sold during the year are in the campaign periods and the remainder of the time is used to close up prospects uncovered during the campaign. An important factor in the success of these campaigns has been small down payments ($7.50 to $10) with terms extending over eighteen and in some instances as long as 24 months. Another feature has been the use of a premium, usually valued at about $7.50 and which may consist of a water heater, percolator or a credit on the purchase of some other appliance.

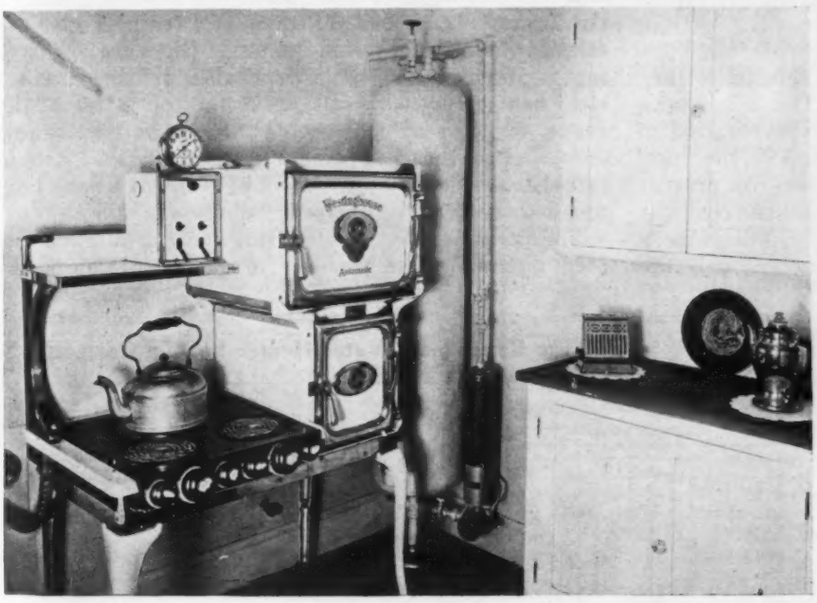
Cooking Schools Valuable

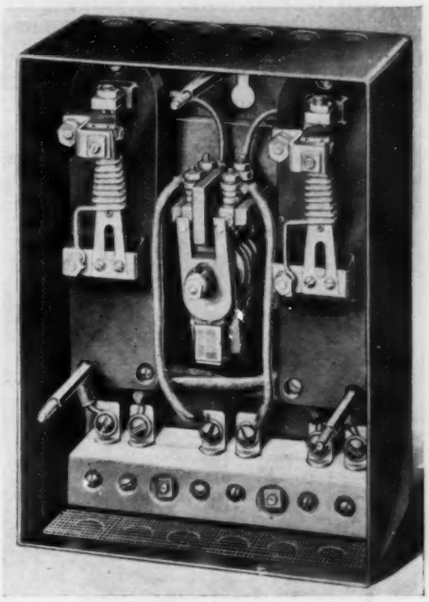
As a means of arousing public interest in the electric range the cooking school idea and community demonstrations have been found most productive of immediate and tangible results. They are most effective in convincing skeptics of the practicability of electric cooking and leave a lasting impression in the minds of prospective users. Total attendance at such demonstrations has often exceeded 10,000, and in some localities housewives look upon them as a permanent institution and frequently inquire when the next one is to be held. The cost of these cooking schools is usually shared by the utility and range manufacturer on a co-operative basis. Sometimes a local newspaper joins in as a third party and the cooking school is given added publicity.

A study of the selling methods used by different companies shows that where the power companies avail themselves of the manufacturers' special sales assistance, demonstration and advertising service, range sales have been made in much larger volume and this load has been put on the lines more rapidly than if these facilities were not taken advantage of.

Salesmen's Compensation

As noted before, a much higher ratio of sales per salesman is found where specially trained range salesmen are employed, and it is desirable to keep the sales force intact throughout the year if possible. Range salesmen are usually paid on a salary and commission basis, although some companies use straight commission and others straight salary. Methods of compensation differ widely, but the more successful companies find that they are able to obtain the best results when the salesmen are able to earn from $2,500 to $4,000 per year. A combination of salary and commission has proved most satisfactory, as it provides the salesman with an incentive to increase his income by hard work, whereas the straight salary removes this incentive.

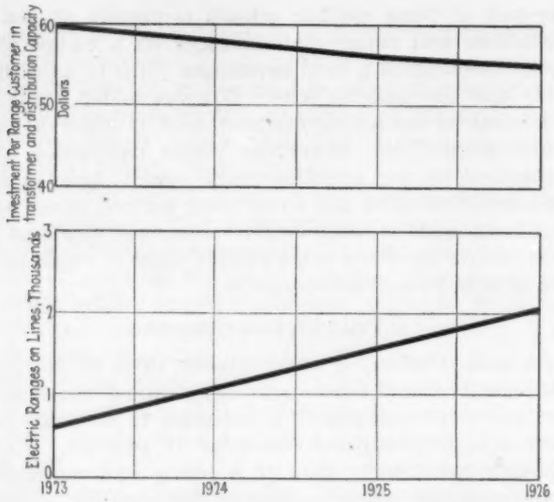




AT LEFT, TYPICAL RANGE AND WATER-HEATER INSTALLATION ON PACIFIC COAST. AT RIGHT, LOAD LIMITING DEVICE FOR RANGE AND WATER-HEATER DEMAND

With specially trained and well-organized range sales forces the volume of sales builds up rapidly and the work goes along smoothly. To sell 1,061 ranges last year one company, with 23,000 residence customers, had eight special salesmen; another employed an average of nine during the year and sold 1,800 ranges. A third company that sold 6,105 ranges used 35 salesmen, and a fourth sold 1,335 ranges with seventeen men. Including three rural district men used by the third company, 72 salesmen sold 10,301 electric ranges. Thus about seven special range salesmen were required to sell 1,000 ranges.

Five years ago Company 25 had only two range salesmen, who worked on "leads" turned in to the office by



HOW INCREASING RANGE SATURATION LOWERS CAPITAL INVESTED TO SERVE RANGE

other salesmen and employees and on this basis they were just about able to keep busy. The range-sales force was increased to six men, who were required to canvass their territories for prospects, and the company began to get real results, as witness its present domestic customer range saturation of 21.7 per cent. It is necessary to "force feed" range sales, otherwise a company will only skim the surface, reaching only the luxury class of purchasers, and use of the electric range does not need to be considered in that category. It is important also that a company map its territory, assign definite districts to each man and keep him in the field continually.

Salesmen should be required to be familiar with every new apartment building or home going up in their districts and to get on the job early. In one city educational work has been carried on for years with architects and builders, with the result that very few new houses are now built that are not wired for an electric range at the time. In fact during the last year 90 per cent of all new homes built in this city were wired for electric ranges.

SIZE AND TYPE OF RANGES SOLD

Cabinet-type ranges of 6.5 to 7.5 kw. total rating with oven temperature regulation or automatic timing device for oven control are proving by far the most popular and easiest ranges to sell. They are extremely attractive in appearance and the automatic features give the salesman additional talking points. One type of range that is proving very popular in small apartment kitchenettes has the oven directly above the top plates of the range, which is so constructed that it can be mounted on a shelf or brackets or built into the wall. Ranges priced to sell installed for from $145 to $175 have been found to be best for campaign purposes.

The question of cost of wiring and installation has been a troublesome problem to central-station range

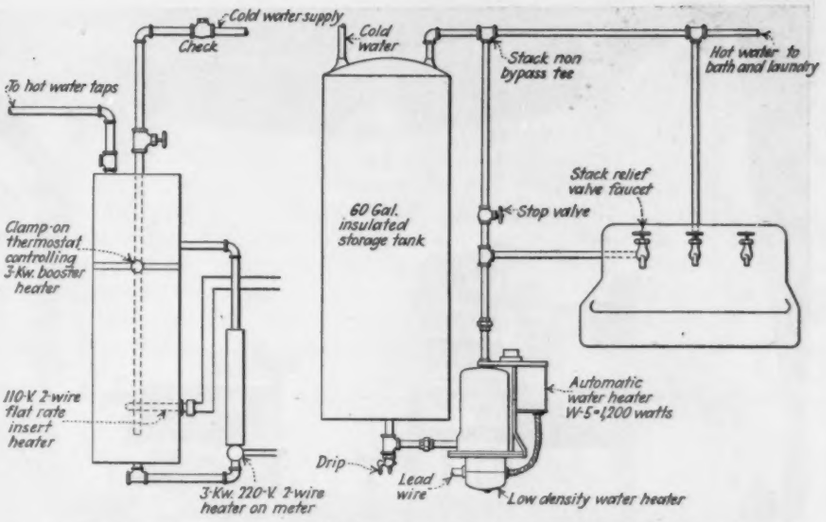
Range and Water-Heater Selling Costs and Servicing

Company	Method of Purchasing	Discount Per Cent	Cost of Selling		Method of Servicing	
			Ranges	Water Heaters	By Whom	Free or Cost
1	Manufacturer's jobber	40	40%	40%	Central station	Free—material in excess $1 charged
2	Carload lots from manufacturer*	45 + 5	$13.50†	.....	Central station	Free one year
3	Manufacturer	40	$39	.....	Central station	Free one year
4	From manufacturer	40 + 5	$35	.....	Central station	All free
5	Jobber	40	.....	.....	Electrical dealer	Charge after one year
6	From manufacturer	50	30%	.....	Central station	Free one year
7	From manufacturer	40 + 5	.....	.....	Cent. sta. and dealer	Free under guarantee
8	From manufacturer	40 + 5	35%	.....	Central station	Free one year
9	From manufacturer	25 + 10 + 10	.....	.....	Central station	Free under guarantee
10	Jobber	35 to 40	30%	30%	Central station	Free under guarantee
11	Jobber	40	.....	.....	Central station	Free under guarantee
12	Jobber	40	.....	.....	Central station	Free under guarantee
13	Manufacturer	40 + 2	15%	15%	Central station	Mostly free
14	Jobber	25 + 10	30%	.....	Central station	Mostly free
15	Jobber	30 + 10	.....	.....	Central station	Free under guarantee
16	Manufacturer	40 + 5	30%	.....	Central station	Mostly free
17	Jobber	30 + 10	.....	.....	Central station	Mostly free
18	Jobber	25 + 10	.....	.....	Dealer	Charge for all
19	Manufacturer	40 + 2	35%	.....	Central station	Free under guarantee
20	Manufacturer	40	$80	$60	Central station	Free one year
21	Manufacturer	40	15%	7%	Central station	Free one year
22	Manufacturer	40	.....	.....	Central station	Free under guarantee
23	Manufacturer	30 + 10	.....	.....	Central station	Mostly free
24	.....	.....	.....	.....	.....	Labor and material after first year
25	.....	.....	.....	.....	.....	Free one year—then material only
26	.....	.....	.....	.....	.....	Free—all
27	.....	.....	.....	.....	.....	Free under guarantee
28	Manufacturer	35	20—40%	20—40%	Central station	Free under guarantee
29	.....	.....	.....	.....	.....	Labor and material after first year
30	.....	.....	.....	.....	.....	.....
31	.....	.....	.....	.....	.....	Material only
32	.....	.....	.....	.....	.....	.....

*L. C. L. from jobber. †Loss per range. ‡Central station show more interest in range. §Few.

men. If the range is priced separately, the cost of wiring must be added, which not only makes the total cost appear high to the customer but forces on the salesmen two selling jobs —one the range, another the wiring. The most satisfactory way has been to quote the price of the range installed, including the wiring. This can be done very easily where the connection charges do not exceed $35, $40 or even $50 and the total price installed is in the neighborhood of $175. When, however, installation costs amount to $75, $90 and $125, as reported in one locality, there is considerable sales resistance to a total price of $200 to $250.

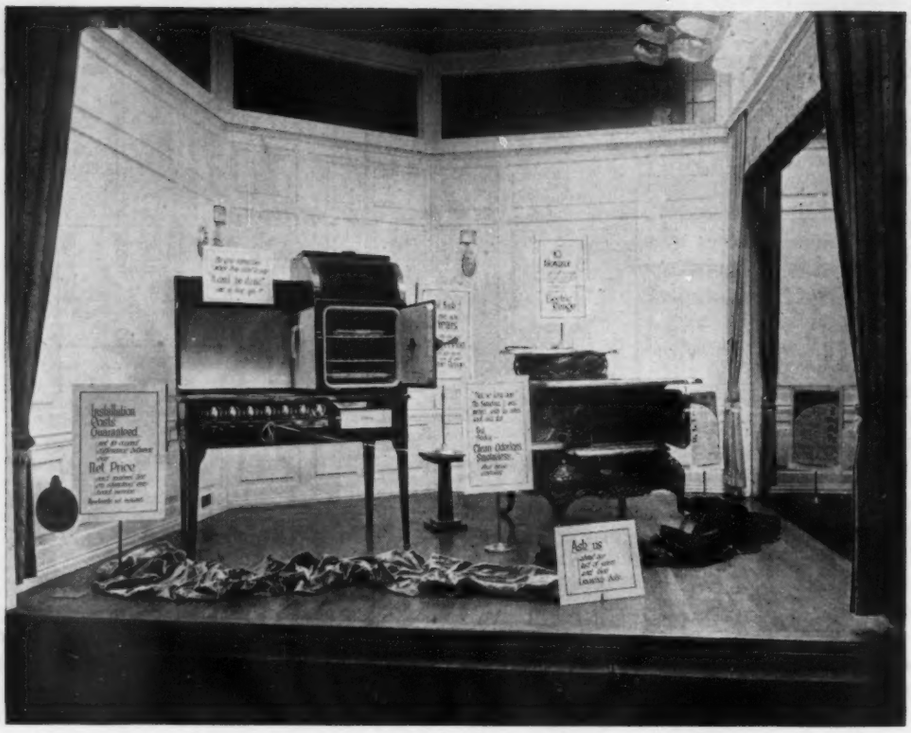
Connection costs vary from a minimum of $20 to an average minimum of about $80, with some higher. Almost all companies pass this charge on to the customer, although some have found it advantageous to absorb part of it as a promotion expense against the profit in the sale of the range. Two companies have definitely set up allowances, one of $25 and the other $35 per range, to help the customer pay for the installation, which in these localities has cost about $80. One company in the East sells ranges at list price and makes the installation free of charge to the customer in order to get the load on its lines. The actual wiring in this case is done by electrical contractors on a time-and-material basis. Only two central-station companies do all their own wiring and installation work, although three others do part of the installation work themselves and turn the rest of it over to the contractors. In 27



AT LEFT, ARRANGEMENT OF 750-WATT BAYONET HEATER WITH HIGH CAPACITY (3 KW.) BOOSTER HEATER. AT RIGHT, COMBINATION STORAGE AND INSTANTANEOUS ELECTRIC HOT WATER HEATING

Practices—Utilities' Attitude Toward Business

Suggested Improvement of Devices		Utility Attitude Toward Profit from Range and Water Heater Business		Other Dealers' Opinion of Range Business	Company
Ranges	Water Heaters	As Merchandise	As Load Builder		
None	None	No profit	Very good	Not interested	1
None	None	No profit	Ranks first	Not interested	2
Switches	.....	Break even	Very good	Not active	3
None	None	Little profit	Very good	Not active	4
None	None	Fair	Very good	Dealers favorable but not active	5
None	.....	Good, some profit	Very good	Dealers favorable but do not sell	6
None	.....	Some profit	Very good	Profitable to dealers—active	7
Switches	None	Break even	Excellent	Not active	8
None	None	Some profit	Good	Not active	9
None	None	Little profit	Very good	Not active	10
None	None	Little profit	Very good	Not active	11
None	None	No profit	Very good	Not active	12
None	None	Some profit	Excellent	Not active	13
None	None	No profit	Very good	Not interested	14
None	None	No profit	Good	Not active	15
More rugged construction	None	Little profit	Very good	Not active	16
Suggest comb. gas and elec.	None	Little profit	Good	Not active	17
.....	.....	No profit to dealers	Indifferent	Dealers would like to see‡	18
Suggest cutout on range	Heating element failures§	Little profit	Very good	Not active	19
None	None	No profit	Excellent	Most dealers inactive	20
Lower prices wanted	Lower prices wanted	Some profit	Very good	Not active	21
.....	.....	Little profit	Good	Not active	22
None	None	Fair	Good	Not active	23
None	None	Little profit	Most desirable domestic load	Not active	24
None	None	Little profit	Most desirable domestic load	Not active	25
None	None	Little profit	Most desirable domestic load	Not active	26
None	None	Little profit	Most desirable domestic load	Not active	27
None	None	Little profit	Most desirable domestic load	Not active	28
None	None	Little profit	Most desirable domestic load	Not active	29
None	None	Little profit	Most desirable domestic load	Not active	30
None	None	Little profit	Most desirable domestic load	Not active	31
None	None	Little profit	Most desirable domestic load	Not active	32



TYPICAL ELECTRIC RANGE DISPLAY IN CENTRAL-STATION WINDOW

localities wiring and installation are done entirely by electrical contractors, but there is no uniform practice as to whether this is at a flat price per range or at cost of labor and material.

High installation costs are believed by central-station companies to be one of the most serious handicaps to the sale of ranges, and it has been pointed out that whereas the electric range has been improved and its cost lowered during the past few years, wiring costs have been increasing. In most instances this condition is blamed upon unreasonable requirements and city ordinances governing range wiring. However, one company, which had been paying $65 to $80 for wiring and connection, installed ten ranges itself at a total cost of $32.50 per range.

Electric Water Heating

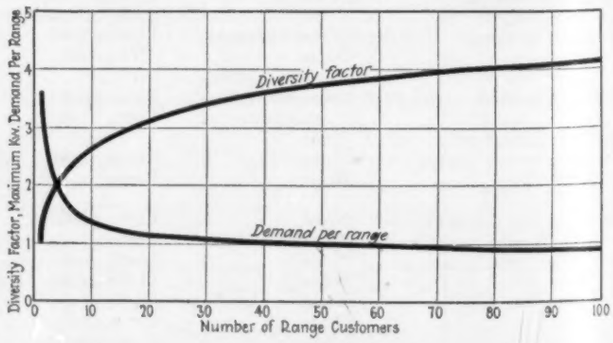
Practice in the sale and installation of electric water heaters by companies developing this load is by no means so uniform as with the electric range. The size of heaters sold varies from 600 watts to 6,000 watts and the types include bayonet, clamp-on, circulating and some automatic. Probably the most popular type at the present time is a 3-kw., circulating, manually controlled electric heater operated on the metered range circuit either with or without a double-throw switch to cut out the range or water heater when the other is operating. Another type of electric water heating that gives promise of very satisfactory results is a combination of low-wattage (750 to 1,000 watts) heater for continuous operation with a 3 to 5-kw. booster unit to supply hot water quickly.

There is considerable sentiment against the use of double-throw switches, as they inconvenience the customer and hamper his use of the service. On the other hand, opinion seems to favor some means of limiting the combined range and water heater demand. Automatic load-limiting devices recently placed on the market may prove the answer to this problem, at least until further experience shows that with the full electrical equipment of the home, including lighting, range, water heater and small appliances, the combined internal and other customer diversity will take care of the demand on the system.

Originally the electric water heater became an adjunct of the electric range, because it was necessary to provide a means of heating water when the coal range was removed. At that time low-wattage heaters (600 to 1,000 watts) were installed on flat rates. However, customers wanted a more rapid means of heating water than was possible with heaters of such low capacity. Also there has been a strong tendency away from flat rates. These conditions have led to the use of larger-capacity heaters on metered service, with the result that it has been found that the kilowatt-hour consumption of the water heater is from one and one-half to four times that of the range. Furthermore, under favorable conditions, water heating can be made almost an entirely off-peak load, or if desired can be operated at close to 100 per cent load factor. A household electrical device that will add from 2,000 to 6,000 kw.-hr. per year to the individual domestic customer's consumption presents a most attractive load-building opportunity to central-station companies on that part of their systems where it is most needed.

A study of electric water heating on the Pacific Coast covering 7,183 customers using this service showed that it was practicable at a meter rate of 2 cents per kilowatt-hour. On an average a 3-kw. automatic heater consumed 6,888 kw.-hr., earning an annual revenue of $137.76, or $45.92 per kilowatt of connected load.

Electric ranges and water heaters are purchased by most central-station companies in carload lots direct from the manufacturer or through the manufacturer's



DESIRABLE LOW-DEMAND AND HIGH-DIVERSITY FACTOR OF ELECTRIC RANGE

jobber at discounts ranging from 35 per cent to 45.5 per cent, depending on whether or not a freight allowance is made and on the total quantity bought during the year. Companies whose sales do not warrant buying in carload lots usually purchase from jobbers at proportionate discounts. Comparatively little complaint was found as to the discounts allowed, although a few companies would like to see lower prices. Selling costs as reported ran from 30 to 40 per cent of list prices, with some figures of 15 and 20 per cent, about which the companies themselves were skeptical, as all advertising and demonstration expenses had not been included. The cause of these apparently high selling costs was usually given as demonstration expense or the fact that the company had absorbed a part of the cost of installation. Only one company reported an actual merchandising loss on its range sales. Six companies reported that some profit or a fair profit was being made, whereas the others were either breaking even or did not care to make any profit on the actual sale.

Service and maintenance of electric ranges and water heaters are important considerations in the successful promotion of this business. Power companies have found that prompt and efficient attention in the matter of making repairs on appliances in service is one of their greatest assets in making future sales. It is the prac-

Trends and Conclusions

Examination of the experiences and results obtained by 32 companies in building a range and water-heater load on their residential circuits leads to a number of significant conclusions as to the nature of this business, methods followed and opinion of its desirability.

1 As a positive and rapid means of effecting marked increases in domestic energy consumption the electric range and water-heater will produce the maximum results.

2 Central-station companies that have seriously undertaken building this load are thoroughly convinced of its value as a net revenue producer and find that this feature increases with the degree of saturation.

3 Electric ranges can be profitably sold by companies operating in cheap natural gas territory, by combination gas and electric companies and by steam-generating as well as hydro-generating companies.

4 Percentage of domestic customers which may be considered as bona fide users of electric ranges and water heaters increases as the degree of saturation increases. The present estimated market for ranges of 26.8 per cent and for water heaters of 15.5 per cent of domestic customers will very likely be placed at 50 and 25 per cent respectively before the end of five years.

5 Capital investment in transformer and distribution system capacity to serve the range decreases as the number of users builds up. This investment to serve the range load also provides capacity for almost unlimited increase in consumption per customer, so all of this additional investment cannot be charged against the range. Incidentally many distribution systems should be rebuilt anyway.

6 Design and appearance of ranges make them attractive merchandise to sell. There is little fault to be found with mechanical construction and they are comparatively free from serious service troubles. Cost of repair and maintenance has been decreasing over the last five years.

7 Selling electric ranges is a specialized job that can be done best by full-time range salesmen.

8 Cooking schools and demonstrations are the best means of arousing and maintaining public interest in electric cooking. Such schools should be held periodically in every locality where the electric range is sold. Those companies with highest customer saturation find such demonstrations extremely profitable. Visits of home economists to range users are valuable means of creating customer satisfaction.

9 Manufacturers' assistance in furnishing specialists, demonstrators and advertising material during campaign periods is of great value to the central-station company. No company desirous of getting the maximum results from its range activity should fail to take advantage of this service.

10 Ranges can be sold most readily when priced installed, as it eliminates the secondary task of selling the wiring job.

11 Connection costs appear very high in some localities, and lightening of excessively rigid requirements and lower wiring costs would serve to stimulate range sales.

12 Domestic electric cooking is practicable at rates up to 5 cents per kilowatt-hour, but 3 and 4 cents is the most popular rate and much easier to sell.

13 Electric water heating begins to appeal to customers at about a 2.5 cent rate, but no great volume of business can be obtained until a 2-cent rate is available. The high load factor of this service merits serious consideration from utility companies desirous of raising their per customer consumption.

14 Use of a manually operated double-throw switch between range and water heater is not greatly favored, but automatic devices for limiting load may solve the question of control of customer's maximum demand.

15 Many companies have rates suitable for range and water-heater service, but very few have fully developed the inducement feature that will best encourage and reward long-hour service with a low rate. The majority of companies offer a special rate for range and water-heater service separately metered, but there is a tendency toward a type of rate that will put all domestic lighting and appliances on one meter.

16 Best type of water heater has yet to be determined, but at present a 3 to 4-kw. circulating heater, either manually or automatically controlled, seems to be favored.

17 Companies with "fringe" or outlying territory are finding it advantageous to start range developments in such districts and work into the more densely populated areas.

18 At present rates the electric range returns an annual revenue of close to $100 per kilowatt of maximum demand upon the system and the electric water heater at a 2-cent rate and even a flat rate for low-wattage heaters returns an annual revenue of from $45 to $50 per kilowatt of maximum demand.

19 Companies having a fair saturation of range users estimate the additional return (net revenue) from the additional investment necessary to serve the electric range at from 8 to 40 per cent.

20 The electric range alone will virtually double the present load factor of the average domestic customer, and the addition of the water heater will give the residential load characteristics similar to that of many desirable industrial loads.

21 The electric range and water heater load when actively developed by the central-station company increases the net revenue from domestic customers.

tice of all companies selling ranges and water heaters to render free service for at least one year or the period covered by the guarantee. Seven companies are supplying virtually all service free of charge regardless of the length of time the appliance has been in use, feeling that this practice has a good will and advertising value far greater than its cost. The most general practice is to charge for labor and material at cost plus 10 per cent after the first year, although several companies charge only for material used.

RANGE SERVICE AND REPAIR COSTS DECREASE WITH TIME

It has been the experience of companies that range service and repair costs have decreased steadily from year to year. A large part of this decrease is attributed to steady improvement in the design and construction of the range, and also greater experience and efficiency of service men. The greater number of ranges in use has helped to lower the unit cost. For instance, one company whose average servicing cost per range was $7.88 in 1920 had reduced this to $3.13 per range in 1926. Another company, which charges the customer for labor and material at cost after the first year, found that the overhead expense of the service department, which was borne by the company, amounted to 40 cents per range service call. This company had 5,500 ranges on its lines and the number of service calls was almost exactly one per range per year.

Service costs as represented by a survey covering fifteen companies having 35,000 ranges were found to average $3.78 per range per year, including all charges for labor and material, part of which is passed on to the customer by those companies charging for repairs after expiration of the guarantee.

Comparatively little fault is found by central-station companies with the present design and construction of the electric ranges. Some suggestions looking to more rugged construction were made, and better packing and crating for shipment are desired. Burned-out heating elements is the most frequent cause for service calls, but this is not considered burdensome. Standardization of range parts, perfection of automatic devices and improvement of switch contacts, coils and enamel are suggested as desirable.

ADVANTAGES OF RANGES AND WATER HEATERS AS LOAD BUILDERS SUMMARIZED

To these central-station companies the electric range and water heater are load builders, being classed in this respect as "good," "very good," "excellent" and by some the "most desirable domestic load." The attitude of those companies that are actively developing both range and water-heater business may be summed up in the statement by one utility executive who has made an analysis of the load upon his company's system and found it has these advantages:

1. Better load factor.
2. Improved power factor through addition of 100 per cent power factor load.
3. Reduction of unaccounted for losses through better distribution, use of district transformers and reduced percentage of 24-hour losses in transformer and meter coils.
4. Increased income from lighting business due to improved distribution.
5. Improved ratio of invested capital to gross revenue, which is a permanent betterment.
6. Increased gross and net revenue from residence customers.

Letters from Our Readers

General-Purpose Secondary Circuits

To the Editor of the ELECTRICAL WORLD:

I have read with a great deal of interest Alex Dow's letter on the above subject in your issue of March 21, and while not presuming to argue with this famous Scotchman, I venture to think that a good case can be put forward for the so-called "English system"—three-phase, four-wire, 380/220-volt. There can be no doubt that the American single-phase 110-volt system is safer in the case of actual shock, but I contend that, if due precautions are taken, the danger of shock is so remote as to be non-existent.

The precautions that I suggest should be taken are as follows: (1) The neutral wire should be grounded to the water mains, twice at every substation and at every house. (2) No fuses, switches or screw joints should be allowed in the neutral wire; where possible all connections on the neutral wire should be by looping in and out. (3) All appliance outlets or "plugs" should be of the "polarized" type, such that the connection to the neutral is made first before the "live" connection; the "live" terminal should be of the flat type with an opening too small to be touched by little fingers. (4) All wiring (including flexibles) should be of the marked type, with full insulation on the live wire but little, or even none, on the earth wire. (5) All appliances such as irons, kettles (which by the way are seldom seen in America), fans, etc., should have the neutral wire solidly soldered to the frames of the appliances.

I submit that if the above precautions are carried out, there is absolutely no danger of shock; also the cost of wiring becomes less than where full insulation is placed on both wires. I understand that the Cleveland Electric Illuminating Company has for some years past used the bare neutral system for 110 volts with satisfactory results, and I feel certain that if this company were once to try the 380/220-volt, four-wire system it would never return to the older 110 volts.

The great advantage of the 380/220-volt, four-wire system is that it costs less than half as much as the American system. It allows transformers to be spaced at double, or treble, the present distances; consequently the substations can be fewer in number but of larger capacity, which allows of a better diversity factor, lower iron loss and very much lower capital cost. The effect of the higher voltage on the mains soon becomes apparent, as the lighting lines become available for ordinary power purposes and special low-tension power mains are not essential for motors of up to 50 hp.

The high cost of running house services for electric cookers, etc., is one of the restraining factors in the domestic use of electricity, and this cost would be halved at least by the use of 380/220-volt mains. There is no doubt that 110-volt lamps are better than 220-volt lamps (50-volt lamps are better still!), but this advantage to the user is more than offset by the greater difficulty of maintaining a correct voltage in the case of

the lower-voltage systems. It is interesting to find that New Zealand, having the choice of all systems, has standardized definitely on 400/230-volt, four-wire, and it is found that there is a distinct tendency in Europe to change from the older 110-volt to 230-volt; but there has never been a case known to the writer where the reverse has taken place. There must be many thousands of millions of dollars sunk in low-tension mains in America, half at least of which could be saved, with material advantage to the users of electricity, if the higher voltage were adopted.

The system for which the writer is responsible is a comparatively small one of a total generating capacity of 5,000 kw. The total capital cost, including the steam-driven station and all outside mains, etc., right up to the consumers' meters, is only $105 per kilowatt. This low figure has been attained largely owing to the fact that our low-tension mains are 380/220-volt, three-phase, four-wire. Mr. Dow, in concluding his letter, suggests that our engineers put more thought, more study, more experiment into the development of better general-purpose secondaries. "Such secondaries are possible," he says, and I submit that the solution is the 380/220-volt, four-wire system.

R. A. WILLIAMS,
British Municipal Council, Electrical Engineer.
Tientsin, North China.

Critic of Interconnection Points to Loss of 10,000,000,000 Kw.-Hr.

To the Editor of the ELECTRICAL WORLD:

In the April 30 issue of the ELECTRICAL WORLD the 1926 production of electrical energy was figured at some 67,000,000,000 kw.-hr. The loss incident to the distribution of this product was about 15 per cent, so the efficiency of the process was only about 85 per cent. The electrical engineer of today talks a lot about his alternator being better than 97 per cent efficient and his transformer being better than 99 per cent efficient. He seldom associates efficiencies of 85 per cent with anything big—only with small apparatus. But here we have this colossus with an efficiency of only 85 per cent, and it is not showing signs of much improvement.

The companies are so busy interconnecting that they cannot bother with a loss of a mere 10,000,000,000 kw.-hr. It is this very interconnection that is contributing to some extent to continue this loss. The average watt-hour that gets to the ultimate consumer has been through many vicissitudes; its voltage has been boosted and lowered time and time again, and furthermore, its frequency may have been changed so that it is no longer the simple, unsophisticated watt-hour that used to be produced in the old New York Pearl Street station. The watt-hour that produces light in my office has been transformed seven times, besides traveling over three separate transmission lines in its journey from the source. Perhaps in the old days the current was well named "direct," for it came direct from the producer to the consumer. Nowadays the current alternates across country before it is finally delivered to the householder.

Consider this viewpoint in a quantitative way. In Fig. 1 is plotted a curve which shows the gradual attenuation of efficiency as a kilowatt-hour is sent through transformation steps. For example, a kilowatt-hour that is put through seven transformers, each of 98 per cent efficiency, emerges from the process reduced to only 0.868 kw.-hr. Fig. 2, a curve similar to Fig. 1, is suitable for studying the loss chargeable to transmission lines. For example, a kilowatt-hour that has to pass over three transmission lines, each of 85 per cent efficiency, is reduced to 0.613 kw.-hr.

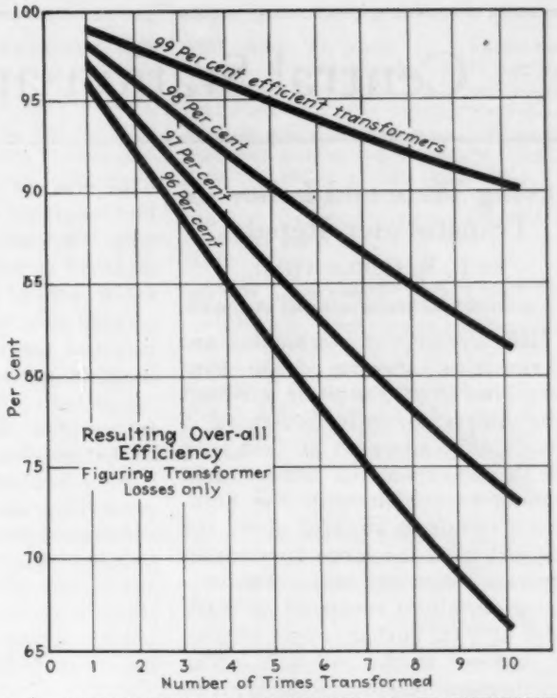


FIG. 1—ATTENUATION OF EFFICIENCY AS TRANSFORMATION PROCEEDS

From the point of view of the load dispatcher, the conclusion is that it does not pay to trot the kilowatt-hours up and down too much before turning them over to the customer. Of course, the main object in the life of the dispatcher is to get the kilowatt-hours to the consumer, even though they have to go all around Robin Hood's barn first. Perhaps, however, arrangements can be made to encourage a more direct routing between producer and consumer. This ideal of reducing the number of transformations of the kilowatt-hour to a minimum will certainly reduce the 10,000,000,000 kw.-hr. loss. Of course, there are, besides, many other important factors in this big problem, all of which are slighted in order to focus attention on the single point here emphasized. Until, however, the zeal for interconnection has somewhat subsided little may be expected in straightening out the routes. Like the railroads, first the independent lines, then interconnections and then through trunk-line service without changing cars.

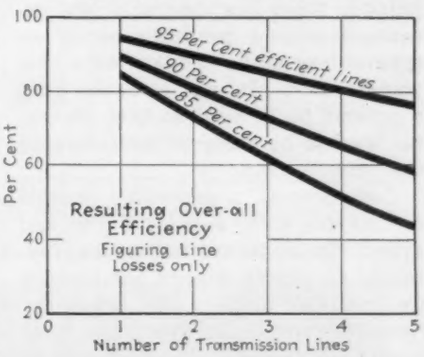


FIG. 2 — LOSS OF ENERGY MOUNTS AS CURRENT IS TRANSFERRED OVER INTERCONNECTED LINES TO ULTIMATE DESTINATION

LEONARD A. DOGGETT.
Pennsylvania State College,
State College, Pa.

Central Station and Industrial Practice

Saving Time and Labor in Transformer Repair

By E. W. Schlichting
New York Service Department, Westinghouse Electric & Manufacturing Company

THE necessity of overhauling and repairing twelve 4,400-kva., 6,300/170-volt, three-phase air-blast transformers recently presented a problem that appeared at first both difficult and expensive. These transformers were built with the high-tension terminals situated above the coils and with the large low-tension terminals below the coils. The low-tension terminals consisted of three pieces of ½-in. busbar copper riveted and soldered to the coil ends. The transformers had become dirty, considerably reducing the ventilation, so that the transformers overheated and melted the solder in the terminals.

It was found necessary to take off the old low-tension terminals and replace them with new ones. Soldering irons would not impart their heat quickly enough to the large terminals to heat them up. Due to the fire risk, flame torches could not be used unless the transformers were turned on a side. In many cases rigging was impractical because of the proximity to other live apparatus and because it would probably entail an expense exceeding the cost of a new transformer. It was essential that a scheme be devised so that the repairs could be made without moving the transformers.

Consequently a generator capable of carrying 6,000 amp. at 4 volts and driven by a 50-hp. motor was obtained to supply energy for heating up each terminal while soldering. Special flexible leads were made from laminated copper. For terminals flat pieces of carbon (½x6x6 in.) were secured by countersunk screws to pieces of slightly larger copper and riveted on the end of the laminated copper lead. One carbon contact was then fastened on each side of the low-tension transformer terminal with an insulating clamp.

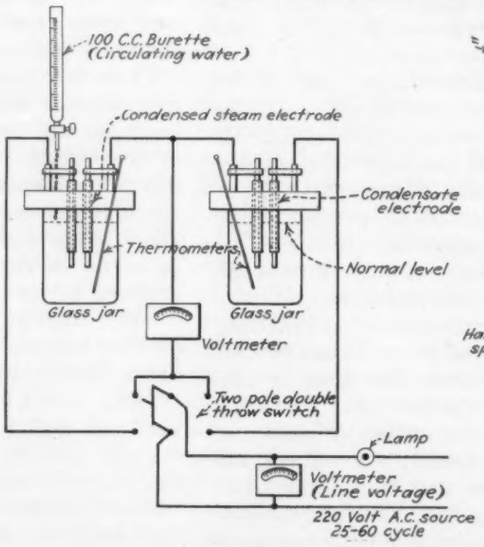
When sweating off the old lugs a current of 4,000 amp. was used. The terminal would drop off in about two minutes. This was a great time saver and the heat was applied so quickly that very little traveled up into the coils.

In making up the new terminal a lower current was used—about 2,000 amp. A soldering temperature was attained in four and a half minutes, after which the current was decreased to a value that would maintain the temperature approximately constant until all the soldering was completed. Then the current was interrupted, allowing the solder to set before removing the clamps.

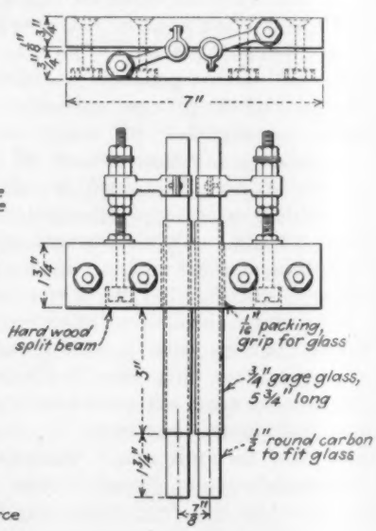
This equipment proved to be a great time and labor saving device, although expensive and not applicable to every job. Although its cost was high, it justified its use in the money saved on the first two transformers. Undoubtedly a less expensive equipment could be built to perform the same work, where alternating current is available, by using the iron of a burned-out 15 or 20-kva. shell type transformer and using 200 or 300 primary turns for 220 or 110 volts. The secondary winding could be made with one or two turns of 1,000,000-circ.mil cable attached to the carbon contacts. This size cable would carry the required current for the short time necessary to do the soldering.

Electrolytic Method for Testing Condenser Leakage

By A. E. Grunert
Efficiency Engineer, Operating Department, Commonwealth Edison Company, Chicago, Ill.



TITRATION APPARATUS

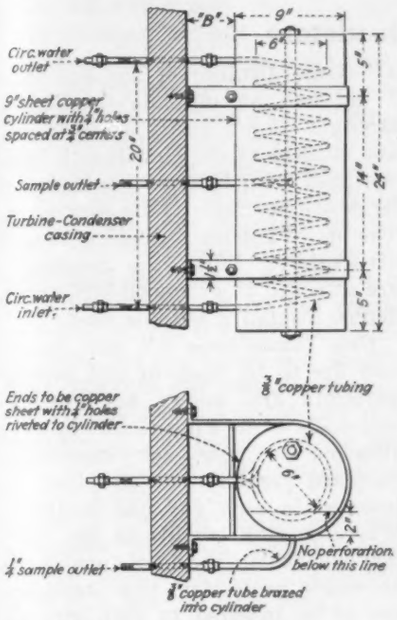


DETAIL OF ELECTRODES

THE testing of condensate to indicate the amount of condenser leakage is quite commonly done by comparing the electrical resistance of a sample of water drawn from the hot well with the resistance of a sample of condensed steam taken from the body of the condenser. The technique of comparison usually consists of measuring the voltage drop across a fixed electrode separation in the first sample and adding measured quantities of condensing water to the second sample until the same voltage drop is obtained across an equal separation. The amount of condensing water added to the second sample is a measure of the comparative purity of the first, the quantity added being directly proportional to the condenser leakage. For convenience in routine checking the testing apparatus, consisting of an alternating-current supply, two glass jars with the carbon electrodes suspended in them and one of them with a burette supported above it, a voltmeter, a double-throw switch and the necessary wiring, is usually set up permanently in the laboratory.

In the plants of the Commonwealth Edison Company at Chicago

there were indications that the sample commonly taken by collecting condensate on a shallow pan located in the body of the condenser was not representative pure condensate, that it might be contaminated by leakage from a split tube above it. In order to make perfect assurance of



STEAM CONDENSING COIL IN EXHAUST HEADER

its purity it was decided to secure the sample ahead of the condenser, as near the last turbine stage as was practicable. Accordingly, the condensing coil shown in the drawing was devised and was installed in the turbine exhaust take-off at a convenient place in the flare to the turbine.

The condensing coil consists simply of a copper cylinder containing a coil of tubing in which condensing water is circulated. The cylinder is closed at both ends and is bored generously over about two-thirds of its surface area, reckoned circumferentially, with rather large holes. It is installed inside the exhaust pipe in a horizontal position with the unbored portion of its surface at the bottom. The exhaust steam is entrapped through the holes, condensed on the coil and collected in the bottom of the cylinder, from where it is drawn off to the outside in a copper tube fitted with a pet-cock. The sample is taken in a flask with a single tube passing through the cork. The tube is connected to the pet-cock, which is then opened. The air in the flask is quickly exhausted and water soon begins to flow in.

The reason for the design of this still, departing from the simple arrangement of a coil supported over a pan, lies, of course, in the velocity of the steam at the point where distillation is accomplished. Without the protection of the upper part of the cylindrical shell, the water condensing on the cooling coil would be blown away as fast as the drops formed.

An Aid to Specification Writing

A SERIAL report of the prime movers committee of the National Electric Light Association on the subject of specification writing has recently been issued. It contains an outline of and suggested forms for instructions to bidders and specifications for economizers, chain-grate stokers, induced draft fans and turbo-generators.

An outline of a sample specification for the electrical end of a turbo-generator is given here as an example of the suggested practice in this respect. The specification as written is expected to cover the furnishing (delivery and erection) of both steam turbines and alternating-current generators with necessary auxiliaries for the power plant.

GENERATOR (S)

24. Rating.—(Each) generator shall be rated at (12,500) kva. or (10,000) kw. at (80) per cent power factor and shall be designed for normal operation at (6,600) volts, (three) phase, (60) cycles. Speed not over (....) r.p.m.

25. Stator Frame(s).—Shall be of the inclosed type. The end bells shall be easily removable. (Each end bell shall have at least .... hand holes having hinged covers and equipped with glass not less than ¼ in. thick so that ends of stator winding may be inspected while in service). (A .... in. diameter perforated ring pipe shall be provided inside of each end bell. Pipe shall be brought out through the end bell and the ends fitted with insulating joints to connect with the .... supply).

26. Rotor(s).—(Each rotor shall be arranged for starting and running generator as a synchronous condenser).

27. Coupling(s).—The coupling between (each) generator rotor and turbine shall be so arranged that the generator may be easily and quickly disconnected from the turbine (and operated as a synchronous condenser while turbine is out of service).

28. Terminals.—Leads from stator and rotor windings shall be designed for connection to cables and shall be provided with copper terminals of number and size approved by the purchaser.

29. Alternate — Terminals. — Leads from stator and rotor windings shall be designed for connection to bus; size and spacing of connections to be approved by the purchaser.

30. Differential Protection. — Both ends of each phase winding shall be brought out at (....) for differential protection.

31. Temperature Detectors.—At least (six) temperature indicating coils or thermocouples shall be provided in the stator winding of (each) generator and brought out to a terminal block on the stator frame. The necessary meters or indicators for switchboard mounting and cable shall also be provided.

[NOTE: For generators of 500 kva. and less capacity these detector coils may be omitted.]

32. Grounded Neutral(s).—(Each generator will be operated with neutral grounded through a resistance.)

33. Exciter(s).—(Each) generator shall be provided with a direct-connected (....) wound exciter to operate at (....) volts. (If exciter is compound wound) the voltage shall be

Night Lighting Avoided Interruption of Construction Work at Conowingo (Pa.) Hydro-Electric Plant

(....) volts at no load and (....) volts at full load. The exciter shall have sufficient capacity to allow the generator to operate at (105) per cent of normal voltage at (80) per cent power factor at full rated load. Exciter shall be suitable for operation (with) vibrating-type voltage regulator.

[NOTE: If parallel excitation is desired, the above paragraph should be modified to suit conditions and complete information given.]

34. Exciter Rheostat(s).—Shall be (hand) operated and for (back of board) mounting. (The resistance of each rheostat in the range from ..... volts to ..... volts shall be such that at full load the increase in voltage of the exciter shall not exceed 1 per cent of the normal voltage per step on the rheostat).

35. Generator Field Rheostat(s).—Shall be (hand) operated and for (back of board) mounting. (Each) rheostat shall have sufficient resistance to regulate the excitation from no load on the generator to full rated kva. at (....) per cent power factor and (....) voltage when exciter voltage is held at (....) volts. Suitable field discharge resistance shall be provided for (back of board) mounting.

36. Parallel Operation.—Generator(s) shall be designed to operate successfully in parallel with (....). Exciter(s) shall be designed to operate successfully in parallel with (....).

[NOTE: If either generators or exciters will be required to operate in parallel with other equipment now in service, give complete name plate data of such equipment.]

37. Temperature.—The temperature rise of all parts of (each) generator (and direct-connected exciter) above ambient air temperature of 40 deg. C. with continuous specified maximum output, voltage, frequency and lagging power factor shall not exceed the following:

Generator rotor, (....) deg. C.
Generator stator, (....) deg. C.
Exciter armature, (....) deg. C.
Exciter field, (....) deg. C.

Temperatures shall be measured as follows:

Generator rotor by resistance.
Generator stator by (permanent detector coils) (thermometer).
Exciter armature by (thermometer).
Exciter field by (resistance) (thermometer).

In determining the temperature rise, proper correction factors shall be applied in accordance with the latest standards of the A.I.E.E.

38. Ventilation.—(Each) generator shall be provided with suitable fan(s) for circulating cooling air through the windings. Inlet and outlet openings shall be provided and located (....).

Rural-Line Specifications—V

Of the Wisconsin Power & Light Company

Pins and Insulators

THE four-pin, 8-ft., and two-pin, 3-ft. 2-in. arm is provided with $\frac{13}{16}$-in. pin-holes for galvanized forged-steel pins with $\frac{5}{8}$ x $5\frac{1}{2}$-in. shank and $4\frac{3}{4}$-in. high above arm with 1-in. threaded lead head.

Between the nut and the bottom of the arm is to be placed a $2\frac{1}{2}$ x $2\frac{1}{2}$ x $\frac{5}{16}$-in. ($\frac{13}{16}$-in. hole) galvanized square washer with $\frac{5}{16}$-in. nail hole. After pin has been assembled a six-penny galvanized nail is to be driven through the small hole, which will keep the nut from coming off. The head of the nail is to be left protruding below the nut about $\frac{1}{4}$ in., permitting easy removal. If pins come shipped with a $1\frac{3}{4}$-in. diameter $\frac{13}{16}$-in. hole, 10-gage round galvanized washer provided with a nail hole, it may be used in place of the special square washer referred to above.

Pin-Type Insulators.—The pin-type insulators are to be made of wet process porcelain, with a top or saddle groove. The pin-holes are to be standard 1 in. with smooth and uniform glazed threads. All insulators are to have a wet flashover of not less than 35,000 volts, leakage distance of not less than $6\frac{1}{2}$ in., and their nominal line voltage rating shall be approximately 13,000 volts and equivalent to Westinghouse No. 1111.

Suspension Type Insulators.—The insulators used in suspension or dead-end positions are to be made of wet process porcelain having a wet flashover of not less than 35,000 volts, a leakage distance of not less than 7 in., and an ultimate mechanical strength of not less than 5,000 lb., and shall be of the Hewitt link type, equipped with hook at one end and large eye at other, or its equivalent. The above applies to undergrounded structures. When the insulators are attached to grounded structures, double insulation is to be used.

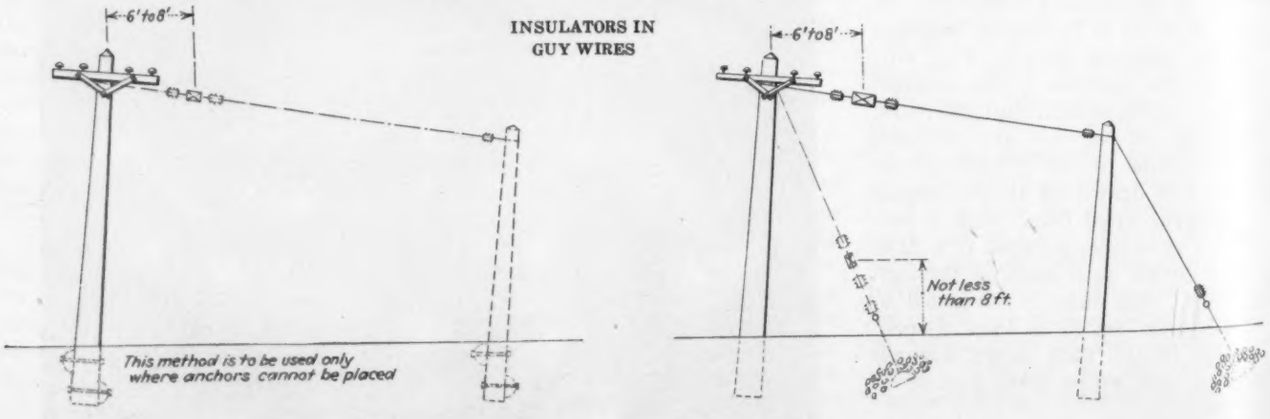
Guy Insulators.—All guy insulators are to be made of wet process porcelain and known as Westinghouse 534 or its equivalent. In guys attached to poles for supporting standard rural lines, there shall be inserted in each guy one insulator. Where guying conditions are such that one insulator will not furnish the necessary protection, two insulators are to be inserted in each guy attached to the line pole. The location of guy insulators is shown on the drawing herewith.

Radio Methods Locate Cable Faults

BY GEORGE H. HAGAR
Assistant to General Superintendent
Great Western Power Company,
San Francisco, Cal.

INACCURACY of the usual bridge methods of locating faults in submarine cables because of the unknown value of the fault resistance has led the Great Western Power Company to adopt a new method of locating cable trouble. A 500-cycle (6,000-meter) current is sent

INSULATORS IN GUY WIRES



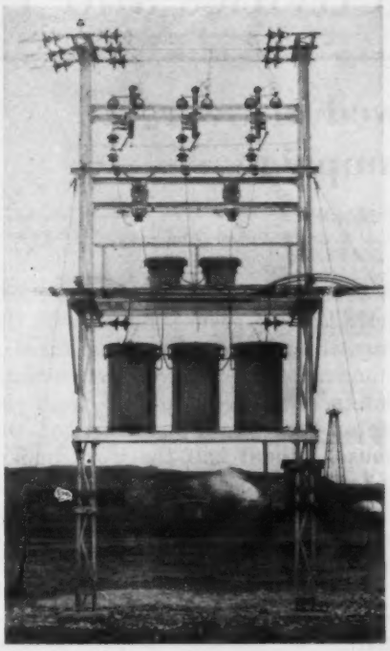
out over the cable from the shore end by connecting a 3-kw. motor-generator between the conductor in trouble and the ground and picking up the hum produced with a loop-operated two-tube receiver on a barge. The 500-cycle current is fed into the cable through a sign flasher to make the signal in the receiver more distinguishable.

In locating a fault the barge is towed along over the cable while the operator listens to the interrupted hum on a pair of head-phones. When the fault is passed, the signal fades out rapidly. The cable is underrun at this point and if the fault is not evident, although it usually is, the radio receiver is used to explore the cable until the spot is found. It is quite possible to get off the course of the cable, but if the signal fades, a circling of the barge will quickly show whether the break has been passed. As evidence of the fact that the cable is not easily lost, in one case this method was successfully used in a dense fog.

During the past six months this equipment has been used on four cases of submarine cable trouble and in no case has the time required to locate the fault exceeded three and one-half hours, whereas the minimum time required by other methods was six hours and from this up to as high as twenty-four hours. In addition to the saving in time it saves underrunning an unnecessary amount of cable, with consequent possible damage to the cable. The method is applicable to either lead-covered or the latest type leadless cable.

The 500-cycle motor-generator set and the radio receiver are both of the navy type and may be purchased by anyone. The receiver costs about $15 and the motor-generator set approximately $1,500.

Semi-Portable Substation Used in Texas Oil Fields



THERE are twenty outdoor switching stations similar to the one illustrated above that are in use on the properties of the Marland Oil Company in its Texas fields. The usual steam boiler and engine are dispensed with and induction motors with wound rotors are belted directly to the well-drilling apparatus. This arrangement gives an adjustable-speed control to meet satisfactorily the drilling conditions, and at the same time it eliminates the fire hazard present with the steam equipment due to gas.

All of these stations are equipped with 50-kva. transformers, 13,200-volt primary, 440-volt secondary, connected delta delta. Current is purchased from the Panhandle Power & Light Company and is metered on the high-tension side. The air-insulated current transformers are mounted directly above the potential transformers, which in turn are placed above the power-transforming equipment. Pellet-type lightning arresters are mounted on the top horizontal member of the structure ahead of the switches. The switching, fusing, choke coils and arrester equipment is of delta-star unit type.

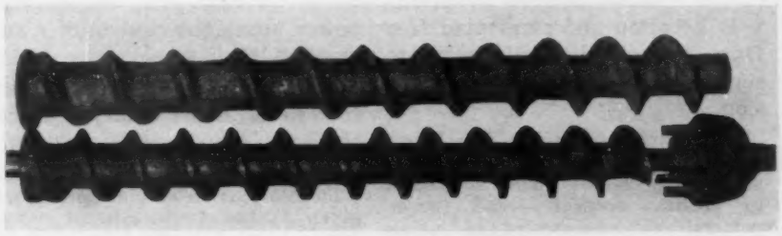
These structures were assembled complete on the ground and then raised by means of a gin pole and dropped into the foundation holes. The bases of the poles were greased before being set in 5 ft. of concrete. If it becomes necessary to remove the switching station to a new location, the erecting operation will be reversed—that is, the gin pile is rigged and the structure pulled from the ground by means of block and tackle and a motor truck.

Steel Supersedes Cast Iron in Feeder Screws

BY IRVIN G. MCCHESNEY
Superintendent of Power Test Section, Rochester Gas & Electric Corporation, Rochester, N. Y.

IN THE design of a cast-iron screw for feeding pulverized coal into boiler furnaces it is necessary to provide ample fillets and a comparatively shallow flight presenting a driving face that slopes backward. These necessary features of the cast-iron feeder design have been found to be decidedly detrimental to satisfactory feeding of the pulverized fuel. The cast-iron screw becomes worn beyond usefulness with scarcely three months of regular operation, the feeding of the screw becomes irregular and the feeder speed has to be advanced to an excessive value to maintain a high boiler rating, according to experiences of this utility.

Engineers of the company have been experimenting for some time with different types of feeder screws and in the use of other than cast iron for their manufacture in an attempt to overcome the difficulties mentioned.



UPPER SCREW WAS MADE OF CAST IRON, LOWER IS OF STEEL

Very satisfactory results have been obtained from a hardened steel feeder screw, and the accompanying illustration shows one of this type which has been taken out of service after thirteen months' operation. The use of the hardened steel unit was found to increase the capacity of the screw about 40 per cent per revolution, and at the same time a perpendicular driving face was made possible in the design. This allowed a high feeding rate to be maintained at low feeder speeds, the greater regularity of feed reflecting most favorably on the operating efficiency of the unit. The steel screw has a life estimated to be at least ten times greater than that of the cast-iron design.

Although the cost of the steel feeder screw is approximately twice that of the cast-iron screw the former has overcome so many of the faults inherent in the cast-iron type that its use is considered distinctly advantageous not only from an engineering but also from an economic point of view.

Commercial Activities and Public Relations

Procedure Followed in Georgia Wiring Campaign

By A. L. Morley
District Maintenance Superintendent Georgia Power Company, Atlanta, Ga.

During the summer of 1926 the Georgia Power Company undertook an intensive house-wiring campaign in the rural districts where no contractors were available for such work. This campaign included wiring in towns and small cities where the distribution systems had been recently purchased by the company and in towns already served but where no special wiring or rewiring sales work had been undertaken. To date more than 1,200 contracts have been completed in the rural districts served by the company.

The merchandise manager was delegated to have all contracts signed and to do all of the soliciting, a 10 per cent cash payment being received at the time the contracts were signed. The contract form used consisted of four copies, one for the customer, one for the nearest district office, one for the auditing department and a field copy for the construction department.

In connection with this sales campaign, time payments were allowed if at least one convenience outlet was installed per room. As part of the campaign, the company instituted a standardized meter connection with safety switch and conduit from the meter board to the outside of the house. About half the work undertaken in this campaign involved changing these meter boards, installing safety switches and from 20 to 30 ft. of conduit per installation.

The construction field copy of the contract form was handled by the district maintenance superintendent, who in turn made up three work orders, one copy being used as a material requisition, another as a cost account copy and the third as a field copy, which was sent direct to the foreman in charge of the wiring crew. On the back of this work order space was provided for the material requisition and cost account. A progress report sheet is kept by the maintenance superintendent showing the number of jobs in each town, the material delivered, etc. Reports from the various foremen are kept as to the date each job is started as well as the completion date. In this way a record is on file at the central office in Atlanta for both material and labor control.

It was not intended that the power company should compete with a local contractor-dealer where there was one, and it was sometimes found advisable and desirable to sublet the wiring to a near-by contractor rather than to do it with company employees. The larger city contractors are cautious, however, about out-of-town work and often are forced to figure so high on labor that the wiring prices are almost prohibitive. It has been found advantageous to hire local electricians who have previously been doing some farm lighting unit wiring and give them a thorough training in up-to-date methods. In this way one or two men are left in the community who are acquainted with the work and who can carry on after the larger crew leaves. Also, the company finds that customer relations are helped by making use of some local labor.

An idea as to the schedule of prices for this work can be gained from the following: The flat rate on what is known as a "short cut-in," including meter board, safety switch

Electric Drive Compared with Older Methods*

1. Location and plant plan free from the old limitations as to source of power and its distribution.

Early manufacturing operations were established at water power sites or in parcels along a stream to utilize several small water powers. These means of using hydro power have passed out of the industrial picture and are now combined into fewer heads that are driving hydro-electric stations tied in with steam stations to form large stable electrical systems. Manufacturing enterprises can now be located in advantageous trade centers and enjoy full power the year round.

2. Improved living conditions and a general uplift in personnel.

3. Greater concentration of power under the control of a few workers.

4. Release of capital and space for direct manufacturing operations.

Under the older systems a considerable portion of plant space was given to the production of power, either in a centralized power house or more often in a number of scattered boiler and engine rooms or waterwheel housings. Purchased power has made it possible to utilize practically every foot of plant for production. It has made available millions of dollars for direct application to production that would otherwise be tied up.

5. Conservation of coal and oil by utilizing water power and by using fuel more effectively.

Conservation of our natural resources has made available vast water powers with consequent direct saving of coal, and it has, by concentrating steam power production into large stations, reduced the coal requirements for the equivalent horsepower as much as fourfold.

6. The speeding up of production makes more output possible per unit of space and per man-hour of labor.

7. Reduction of production costs results from various combinations of all the above, together with marked reductions in the cost of the power that is actually delivered to the work to be done.

*Excerpts from a paper by R. H. Rogers presented before the American Society of Mechanical Engineers, Erie, Pa., June 3, 1927.

MATERIAL REQUISITION AND COST ACCOUNT

DESCRIPTION	Amt. Req.	Unit Cost	Total Cost	REMARKS
B. X. Cable				
Romex Wire				
Wire				
Outlet Boxes				
Conduit				
Fittings				
Porcelain Ins.				
Total Fixture Cost				
Miscellaneous				
Total Cost Material				
Labor				
Electrician				
Helper				
Superintendency				
Total Labor Cost				
Auto Expense				
Other Expense				
Total Miscellaneous Cost				
GRAND TOTAL COST				

BACK OF WORK ORDER COVERING MATERIAL REQUISITION, COST ACCOUNTING AND CONSTRUCTION SPECIFICATIONS

Front of work order is similar to application, the agreement at top of application being supplanted by instructions to install equipment listed at such and such an address. It is also requested that costs be sent to general superintendent.

GU-37—1M 8-16-26 CUSTOMER'S COPY

GEORGIA UTILITIES COMPANY
APPLICATION FOR WIRING AND INSTALLING FIXTURES

Application is hereby made to Georgia Utilities Company for wiring building at No. ..... Street in ..... in accordance with schedule hereto attached and made a part of this agreement. The undersigned agrees to pay the contract price therefore as shown in the schedule at the office of the Company at ..... in the following manner: ..... ($ .....) cash and ..... (.....) on or before the 10th of each succeeding month without interest until the entire amount has been paid. Upon failure to meet any payment when due all the remaining payments shall become due and payable at once. Ten per cent discount will be allowed if the full amount is paid within 10 days after completion of work.

Title to all material and fixture installed under this contract shall remain in Georgia Utilities Company until all amounts due are paid. No changes will be made in outlets after wiring is started, without additional cost.

In witness whereof the parties hereto have executed this instrument this ..... day of ..... 19 .....

Witness. ..... Applicant

Notary Public, State at Large, Ga. GEORGIA UTILITIES CO.,

Per .....

FIXTURE & OUTLET SCHEDULE

LOCATION	CEILING OUTLETS: NO.	FIXTURES: TYPE OR CAT. NO.	FIXTURES: SOCKET KEY OR PULL	DROP (CORDS)	PROVIDED IN (ONLY)	TOTAL (WATTS)	SIDE LIGHT OUTLETS: NO.	BRACKET FIXTURES: TYPE OR CAT. NO.	BRACKET FIXTURES: SOCKET KEY OR PULL	TOTAL (WATTS)	SWITCHES: 1 (POLE)	SWITCHES: 3 (WAY)	SWITCHES: SNAP	CONVENIENCE OUTLETS: (SINGLE)	CONVENIENCE OUTLETS: TOTAL (WATTS)	REMARKS
TOTAL																
RATE $																
TOTAL $																
GRAND TOTAL $																

APPLICATION FOR WIRING AND INSTALLING FIXTURES USED BY GEORGIA COMPANY

and BX or conduit from 20 to 30 ft. long, is $11. This applies where the meter is located in the front of the house and the service comes out of the front of the building. A "long cut-in" costs $14. This applies under the preceding conditions, except that the BX or conduit is figured to be from 30 to 59 ft. in length and the meter is usually located at the rear of the house and the service connection out of the front of the building. Most of the interior work has been done with BX or non-metallic conduit and is installed at about $3.25 per ceiling outlet.

During the campaign the general sales manager of the company asked that as few drop-cords as possible be installed, and as a result a simple chain pendant with pull-chain socket was designed which was installed for $1.75. Range installations vary from $28 to $35 and are usually installed with No. 6 three-wire non-metallic conduit.

During the first eight months of the campaign more than 1,200 contracts have been completed, which adds approximately $20,000 in yearly revenue. About 600 of these averaged nine outlets per job, the remainder consisting only of changing meter switches, installing safety switches, etc. In one small town 51 contracts were executed, which included 45 completely wired houses having a total of 426 outlets.

Wisconsin Test-Farm Data Announced

AFTER two months of experimental operation, the Southern Wisconsin Electric Company has compiled data on energy costs at its model dairy farm. During this period the farm consumed 1,161 kw.-hr., costing $63.81, an average of $6.38 per month. A table has been prepared showing what it costs in a month to operate equipment essential to a dairy farm.

Equipment	Average Cost per Month	Average Cost per Kw.-Hr., Cents	Average Kw.-Hr. per Month	Average Man-Hours Saved per Month
Milking machine	$2.65	9.6	27.6	30
Ironing machine	2.15	5.64	38	8
Pump power	6.09	6.52	93.7	8
Lighting	6.47	11.03	58.6	12
Milkhouse ice machine	6.33	5.57	114	144
Milkhouse water heater	7.55	3.54	213	28
Residence water heater	7.08	3.41	208	40
Range	11.35	3.24	350	40
Residence refrigerator	1.74	4.7	36	4
Total	$51.41	.....	1,138.9	214
Average		4.51		

These data include twenty pieces of other equipment too small to be metered. Figuring the total time saved at 50 cents per hour, less the

cost of electricity, a saving of $55.59 was accomplished in a month. Applied to the cost of equipment, the electrical apparatus would soon pay for itself.

Comparison of Gas and Electric Tempering Furnaces

BY C. E. MURPHY
Power Engineer Sioux City Gas & Electric Company, Sioux City, Iowa

THE test data tabulated in this article show a point in favor of electric heating that is usually conceded to gas. The fuel cost per pound of material treated is shown to be less for electricity than for gas. There are two reasons for this condition: Although the gas furnace was operated in the manner usual in the plant, it was not efficiently operated, and the gas rate quoted is rather high for industrial service.

The furnaces in the test were of the same general type, the gas unit being slightly the larger. They were box type, but were not arranged for full loading of the heat chambers. That is to say, the material was simply laid on the floors of the chambers, not stacked or tiered. This is the reason for the low thermal efficiencies developed. Both furnaces would have shown much higher efficiency figures if they had been loaded to capacity. The electric furnace was 12x24x9 in. with 11 kw. connected. The gas cost was $1.10 per thousand cubic foot and electricity cost 2.2 cents a kilowatt-hour.

Due to the uniform heating it was possible to remove material from the electric furnace in groups of several pieces each. This could not be done with the gas furnace, as the inequality of heat distribution made it necessary to remove each piece separately as it reached tempering heat. For this reason the gas furnace required closer attendance and had a lower output rate. The operator of the gas furnace had several years of experience behind him; the operator of the electric furnace was an apprentice of two months' training. Material spoilage and scaling in the electric furnace was nil, whereas in the other it was a definite factor.

The first eleven tests were made on the electric furnace; the last five on the gas furnace. The materials treated in the tests were as shown in the table above.

TESTS ON ELECTRIC FURNACE

Test No.	Time, Min.	Weight, Lb.	Temperature Rise, Deg. F.	Kw.-Hr. Used	Lb. per Kw.-Hr.	Cost per Lb., Cents	B.t.u. Input	B.t.u. Abs.	Per Cent Eff.
..	73		70 to 1,520	14.00			Furnace heating		
1	22	12.75	60 to 1,600	3.5	3.64	0.605	12,000	2,945	24.6
2	17	12.75	60 to 1,600	3.5	3.64	0.605	12,000	2,945	24.6
3	17	12.75	60 to 1,600	3.0	4.25	0.518	10,250	2,945	28.7
4	19	12.75	60 to 1,600	3.0	4.25	0.518	10,250	2,945	28.7
5	15	12.75	60 to 1,600	2.5	5.10	0.43	8,550	2,945	34.5
6	17	12.75	60 to 1,600	2.5	5.10	0.43	8,550	2,945	34.5
7	28	24.38	60 to 1,600	4.5	5.42	0.406	15,400	5,630	36.6
8	27	34.00	150 to 1,600	4.3	7.90	0.279	14,700	7,860	53.5
9	27	30.60	150 to 1,600	4.4	6.95	0.319	15,050	7,070	47.0
10	33	34.00	150 to 1,600	4.8	7.10	0.31	16,400	7,860	48.0
11	27	20.63	65 to 1,600	3.5	5.90	0.373	12,000	4,750	39.7
Totals	322	220.11	.....	53.5	4.10	0.535	135,000	50,830	37.6

Pounds per kilowatt-hour, excluding furnace heating, 5.57.
Cost per pound, excluding furnace heating, $0.395.

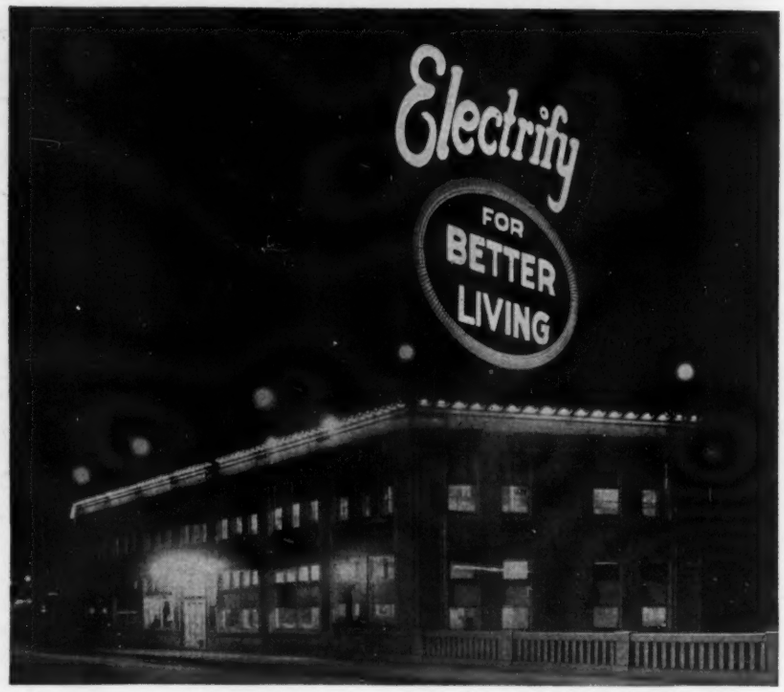
TESTS ON GAS FURNACE

Test No.	Time, Min.	Weight, Lb.	Temperature Rise, Deg. F.	Cu.Ft. Gas	Lb. per Cu.Ft.	Cost per Lb., Cents	B.t.u. Input	B.t.u. Abs.	Per Cent Eff.
..	85	.....	to 1,500	700			Furnace heating		
12	43	26.62	60 to 1,600	250	0.165	1.0340	137,500	6,149	4.50
13	42	27.25	60 to 1,600	150	0.182	0.6050	82,500	6,295	7.65
14	50	32.75	60 to 1,600	130	0.252	0.4400	71,500	7,566	10.56
15	50	32.00	60 to 1,600	120	0.267	0.4125	66,000	7,392	11.20
16	42	27.25	60 to 1,600	150	0.182	0.6050	82,500	6,295	7.65
Total	312	145.87	.....	1,500	0.2096	1.1300	440,000	33,697	7.65

Pounds per cubic feet, excluding furnace heating, 0.2096.
Cost per pound, excluding furnace heating, $0.603.

Test No.	Material	Size
1 to 6	39 pilot stems	6x¼ in.
7	11 pilot stems	6x¼ in.
7	12 axles	10x¾ in.
8 and 10	10 shafts	20x¾ in.
9	9 shafts	20x¾ in.
11	12 axles	10x¾ in.
12 and 13	104 reamers	1½ in. outside
14	40 reamers	2¼ in. outside
15	26 reamers	2¼ in. outside
15	42 reamers	1½ in. outside
16	16 axles	20x¾ in.

Utility's Sign Features Convenience of Electricity



THIS electrical display has just recently been erected on the roof of the Rockford (Ill.) Electric Company's office building. The purpose of adopting a selling phrase for the sign instead of using the company name or the somewhat trite and inadequate "Light, Heat and Power" was to broadcast an unselfish message, according to D. L. Cash, commercial manager. A message was selected that would be a definite influence in building up the local electrical industry in all its branches. It was thought that the power company should be the fountain-head of electrical development in the community and that a willingness to accept and develop the responsibilities that go with such a position in community life might well find expression in electrical advertising of this type.

The sign is 39x45 ft. and the height of the first "E" in "Electrify" is 15½ ft. There are 1,700 sockets in the sign equipped with 50-watt blue lamps in each channel of lettering. Four circuits in the border are equipped with 25-watt spray-colored bulbs.

Digest of Electrical Literature

Units, Measurements and Instruments

Precision Average Voltmeter for Power Frequencies.—C. DANNATT and N. HOLT.—For precision measurements rectification must be complete and exact, with the result that for this particular purpose the choice in instruments lies between mechanical means and thermionic means employing rectifying valves. The authors have had considerable experience with both types of instruments, according to this paper, and have been led to adopt the mechanical type for precision work. The purpose of this article is to give an account of such an instrument capable of an accuracy of 0.1 per cent, to recount other uses for the instrument besides the measure of maximum values —such, for instance, as the plotting of the wave forms of a high-voltage supply—and to consider its advantages over the type of instrument employing rectifying valves. The paper concludes with a brief comparison of the relative advantages of both types of average voltmeters. The commutator type must be driven synchronously with a supply frequency, and its use is limited to the usual power frequencies. The average voltmeter of valve type has no such limitations. The accuracy of the valve type is dependent on available voltage to be measured. Unless approximately 100 volts is available, the non-linearity of the anode-volt, anode-current characteristics of the valve in the vicinity of zero is liable to cause serious error. The error obtained in a well-designed valve-type instrument at varying voltages is dependent upon the actual shape of the wave. The commutator instrument, on the other hand, is capable of 0.1 per cent accuracy on voltages of only one-tenth. Such a measurement is quite impossible with the valve instrument. The valve instrument can only be used for measuring the average value of the positive one-half cycle of voltage. It cannot, therefore, be used for plotting wave forms. Also, in cases where the positive one-half cycle has a subsidiary loop reaching a negative value, this negative area is neglected by the valve instrument, giving a resultant error in the average value.—*World Power*, May, 1927.

Novel Testing Method for Solid Dielectrics.—ED. RENZ.—Solid insulating materials are usually tested for their dielectric strength by being placed between two electrodes for puncture or under two electrodes for creepage. In either case the sample is tested to destruction. The author of this paper suggests, and actually uses, a method which gives comparative values of dielectric strength without destroying the test piece. He brings a slightly rounded metallic point in contact with the surface of the test piece and charges this needle electrode with about 5,000 volts direct current. A highly insulated electrostatic voltmeter measures the applied potential. The feeding line is then interrupted, and by means of a stop watch the time is measured in the seconds which it takes to drop the potential to, say, 2,000 volts. Depending upon the material tested, values of from three seconds to one and one-half minutes are thus measured. The high-voltage direct current is obtained conveniently with the aid of a small high-voltage vacuum-valve tube. — *Elektrotechnische Zeitschrift*, April 21, 1927.

Hydro-Electric Development and Steam Equipment

Le Baton Hydro-Electric Power Station. — This article describes the hydro-electric power station du Baton in the Grenoble district of France. The installation described has two main characteristic features—it works under a higher head than any other French power station and the turbine room has been excavated in solid rock at the foot of the mountain. At low-water periods the station runs during a limited number of hours to contribute to the electric supply of the town of Grenoble. The energy generated during the high-water period is utilized in the electric furnace works at Livet, owned by the company. It will also in the near future serve to operate, together with energy from the company's Vernes power station, 4,800-hp. pumping sets for making up in summer from the River Romanche the storage capacity of the Mort Lake, a reserve which will be available during the winter months. This hydro-electric power plant is the third in the French Alps owned by the Keller & Leleux Company. The first is at Livet, where the head is 197 ft., the maximum flow 6,600 gal. per second and the nominal power 20,000 hp. The second, the Vernes hydro-electric power plant, was built by this firm in 1918. It takes the water flowing from the Livet installation and utilizes it under a head of 66 ft., and the turbines develop 6,700 hp. The three power stations supply energy to the company's adjoining electrochemical and electrometallurgical works.—*Engineering (England)*, May 6, 1927.

Generation, Control, Switching and Protection

Electrical Protection of Generators in Industrial Power Plants.—A. J. WHITCOMB.—Protection of alternating-current generating equipment resolves itself, according to the author, into the following main items: (1) Protecting machines against overspeed; (2) safeguarding generator bearings; (3) protecting the generator windings against overvoltage, excessive current, dirt and overheating. The windings of a generator should be protected against (1) external faults, such as excessive current, either from sustained overloads or short circuits external to the generator; (2) internal faults, such as grounds, phase-to-phase short circuits, short-circuited turns and open circuits; (3) excessive voltage generated in the windings; (4) dirt deposited in the windings from the cooling air, thereby weakening the insulation; (5) fire in the windings; (6) overheating. The author discusses in some detail each of these divisions of the subject and suggests means of protection.—*Power*, May 31, 1927.

Notes on 60,000-Volt Underground Network of the Union d'Electricité.—E. MERCIER.—This paper contains a description of the 60,000-volt underground cable network which has been successfully operated in the Paris district by the Union d'Electricité for the past four years. The reasons why single-core cables were adopted for the distribution system are explained, and a number of details are given in regard to the construction of the cables, the method of laying and the operating conditions, both electrical and thermal.—*Journal of Institution of Electrical Engineers (England)*, May, 1927.

Modern Protective Devices and Their Application.—I. HERLITZ. — A general review of the subject of protective devices, with discussions of the fundamental principles, and the limits of application, of the various devices employed in modern power systems. — *Teknisk Tidskrift, Elektroteknik*, May 7, 1927.

Illumination

Art and Utility in Church Lighting. —J. L. STAIR.—The origin of the various types of church architecture is briefly reviewed, showing that the character of each age has been expressed in the art of its church buildings. The prevalence of innumerable sects and denominations of the Christian church in this country, accounting for a greater variety in religious edifices than exists in any other country in the world, is pointed out, with the resulting complications of the problems confronting the church builder and the illuminating engineer. The use of light in the church as a medium of spiritual and symbolic expression is discussed, attention being called to the fact that the design of lighting equipment and fixtures for churches is one of the very few instances in which there is no medieval precedent to draw upon in furnishing houses of worship. The various types of churches are classified, and the lighting problems of each are discussed from the standpoint of three main aspects, the utilitarian, the esthetic and the hygienic. The problems of lighting different points of the church are presented in detail, and frequent illustrations of good and bad examples are given.—*Transactions of Illuminating Engineering Society*, May, 1927.

Motors and Control

A New Protective Device for Alternating-Current Motors.—J. HÄRDÉN.—A description of a self-regenerative thermal relay, based upon the melting of an alloy, which, in connection with a maximum current relay and a neutral potential relay, provides a protection equivalent to that of an automatic time relay. The thermal relay consists of a heating coil, placed in the square axle of a drum, which through a ratchet wheel locks the spring mechanism of the circuit breaker. Around the square axle is cast a low-melting-point (150

deg. C.) alloy which, when solid, rigidly connects the axle to the drum. The heating coil is fed from a small transformer the primary of which carries the armature current of the motor. For overloads of a certain duration the alloy melts and in so doing releases the drum from the axle, when the circuit breaker is opened. After a short interval the alloy solidifies and the relay is again in its original state. The relay can be adjusted for different maximum currents by adjustments of the transformer. The heating coil is protected from overheating by dimensioning the core of the transformer in such a manner that it is saturated before the current assumes values which are dangerous to the coil.—*Teknisk Tidskrift, Elektroteknik*, May 7, 1927.

Vibration of Frames of Electrical Machines.—J. P. DEN HARTOG.—In connection with the attempts to reduce the noise of electrical machinery in general, and more especially of small motors for domestic use, it is of importance to be able to calculate the natural frequency of the vibration. It is shown in this article that the frame, which usually emits a large portion of the total noise, can in many cases be regarded as a part of a ring with rigid ends. Formulas and curves are given in the paper for the calculation of this fundamental frequency. The derivation of these formulas is provided in an appendix attached to the paper.—*Paper presented before American Society of Mechanical Engineers*, White Sulphur Springs, W. Va., May 23, 1927.

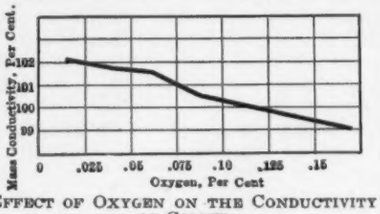
Electric Deep-Well Pumps.—D. W. SICHARDT and L. STEINER.—For the water drainage of excavations for buildings, tunnels, etc., electrically driven pumps are gaining daily in popularity, owing to their reliability and economy. Formerly the single-piston or multi-piston pump or the centrifugal type were used exclusively. In late years a novel motor pumping set was introduced with great success in which the motor and the centrifugal pump have been combined into one unit. A 13-kw., three-phase motor of small diameter but unusually great axial length drives directly a pump of similar dimensions, the whole unit fitting into a well hole of 8 in. diameter. The article by the first-mentioned author describes results with these pumps for water drainage, while the second article deals with the application of the deep-well pump in oil fields. Elaborate cost comparisons are given showing the savings due to the use of these pumps as compared with other pumping methods.—*Siemens Zeitschrift*, March and April, 1927.

Telegraphy, Telephony, Radio and Signals

Direct Comparison of the Loudness of Pure Tones.—B. A. KINGSBURY.—The loudness of eleven pure tones was studied by adjusting the voltage applied to a telephone receiver to make these tones as loud as certain fixed levels of a 700-cycle tone. The average results of 22 observers, eleven men and eleven women, were arranged as contour lines of equal loudness through the normal auditory sensation area in terms of r.m.s. pressure in the ear canal as a function of frequency. Frequencies from 60 to 4,000 cycles were used and intensities from the threshold of audibility to 90 t.u. above the 700-cycle threshold. It was found that if the amplitude of pure tones are increased in equal ratios the loudness of low-frequency tones increases much more rapidly than that of high frequency tones. For frequencies above 700 cycles the rate is nearly uniform.—*Reprint B-245, Bell Telephone Laboratories*, May, 1927.

Electrophysics, Electrochemistry and Batteries

Effect of Impurities in Metals.—C. J. SMITHELLS.—In this series of articles the effect of impurities on the microstructure and on the electrical and mechanical properties of metals is reviewed. Part I, which appeared in the



EFFECT OF OXYGEN ON THE CONDUCTIVITY OF COPPER

April issue of *World Power*, dealt with the effects of gaseous impurities. In the present article the effects of nonmetallic impurities are discussed.—*World Power*, May, 1927.

Direct Determination of Hydrocarbon in Raw Rubber, Gutta Percha, and Related Substances.—A. R. KEMP.—Iodochloride in glacial acetic acid is shown to be a suitable reagent to determine the unsaturation of the hydrocarbon in rubber or gutta percha. The influence of time, temperature, sunlight and reagent concentration upon the reaction is shown. Comparisons are made between iodochloride, iodobromide and bromine relative to their reactions with raw rubber and some of the terpenes. Results of analyses of light and reagent concentration upon several rubber and gutta percha samples are given. The effects of mastication and heat upon the unsaturation of raw rubber are shown.—*Reprint B-246, Bell Telephone Laboratories*, May, 1927.

Heat Applications and Material Handling

Internally Heated Furnaces.—In this article the author recites some of the difficulties which have attended the design and satisfactory operation of electric furnaces. Where furnaces are of large capacity they must be of rugged construction to withstand rough usage and the very heavy abrasive wear occasioned by the continuous introduction of heavy articles and their removal from the chamber. Heating units in such furnaces should be entirely inclosed, according to the opinion expressed in this paper, and it is also considered advisable that the bricks forming the lining and certain other parts of the furnace should be free to expand and contract during the period when they are being heated and while they are cooling. The type of brick recommended is that pierced with longitudinal holes, so that when the bricks are built up to form a chamber the holes in each adjacent brick coincide to form tunnels through which special spiral heating elements, or rods, can be freely drawn, thus allowing uniform heating conditions throughout the entire chamber. The wire spirals or rods, being entirely inclosed in separate tunnels, are prevented from coming into contact with any material being heated in the furnace, and an arrangement of busbars at the far end allows of the linking up of the various units to meet the requirements of one-, two- or three-phase energy supply. One great advantage of this type of electric furnace construction is, according to the author, the ease with which the heating units can be divided to suit particular conditions of supply. In the particular case described there are eighteen spiraled coils to each phase, the arrangement being six coils in series and three in parallel per phase. The maximum working temperature in the chamber is 1,000 deg. C., and the control is automatically accomplished by means of a regulator and switch. In the local energizing circuit is a patented thermal fuse which enters the heating chamber and is connected in series with the relay, time switch, door switch and the energizing coil of the regulator switch.—*Electrical Review (England)*, May 13, 1927.

Miscellaneous

Research on Mechanical Properties of Steel Wire.—WILHELM PUNGEL.—This is the first instalment of a series of articles to be presented on recent investigations of this character in Germany. Translation is made from *Stahl und Eisen*. The purpose of the inquiry recorded in this paper was to determine in what degree the mechanical properties of drawn-steel wire are dependent on natural hardness and elongation due to drawing, and whether the determination of the ultimate bending strength permits a conclusion as to the bending and torsion test numbers. The investigations extended more particularly to the determinations of tensile strength, of the number of bends around a given diameter and of the number of torsions. As the standard for the determination of torsion specimen length for wires of over 2-mm. diameter a length of 200 mm., and for thinner wires a length of 150 mm., was chosen. A turn of 360 deg. counts as a torsion. The alternate torsion and the uniformity of the material was tested. The former was drawn into the investigation, because the greater part of the wires used in hoisting and crane-rope applications, in addition to being judged for flexure, are considered also with reference to the continuously changing twists. The result showed that equal cross-section reductions correspond to equal tensile strengths. The theory is advanced that it ought, therefore, to be possible to determine in advance with what dimension of rod the drawing should be begun in order to produce a finished wire of certain tensile strength and final diameter.—*Wire and Wire Products*, May, 1927.

News of the Industry

Gettle's View of Rate Base

Before Wisconsin Accountants Chairman of State Commission Assails Reproduction-Cost Plan

SPEAKING before the convention of the Accounting Section of the Wisconsin Utilities Association at Green Bay on June 17 and 18, which was attended by representatives of nearly all the electric, gas and transportation companies in the state, L. E. Gettle, chairman of the Wisconsin Railroad Commission, vigorously assailed the reproduction-cost principle of valuation laid down by recent United States Supreme Court decisions, laying particular stress upon the alleged impossibility of reconciling the treatment of overhead expenses and "going value" under that doctrine. He said that the Wisconsin Supreme Court, as well as other state supreme courts, has gone away beyond the intention expressed by the United States Supreme Court in applying the reproduction-cost principle, declaring that the United States Supreme Court decision does not mean that controlling weight must be given to current prices. He applauded the recent decision of the Massachusetts Department of Public Utilities attacking the Supreme Court's attitude and said he believed that it represented the general opinion of virtually all state regulatory commissions.

Mr. Gettle found violent incompatibility in applying the reproduction-cost doctrine to overhead costs and to "going-concern" value, asserting that it would be ridiculous to allow any value for "going concern" where it is shown that a business could not possibly succeed. "The actual investment and the estimated cost of reproduction are so divergent that one cannot be used in lieu of the other," said Commissioner Gettle. "It becomes important that we know whether the cost of reproduction should reflect the historical development of a property or whether it should be an estimate of the cost assuming construction *de novo* and as a unit. The term 'costs' in connection with overhead costs under a strict application of reproduction at current prices would be inapplicable, because in making valuations on the investment basis the cost of engineering and supervision, the interest costs, the cost of organization and legal expense, for taxes, could measurably be ascertained from the accounts of the company. This would not be true for the item listed under 'omissions,' which would have to be based largely upon general experience.

"The value of a utility property as a going concern is the only value which that property can have for purposes of rate making. The theory that that value must always be in excess of the cost or of the estimated cost of reproduction of the physical property is utterly ridiculous. The utility which has not earned a profit and has no prospects of earning a profit is not worth the cost of its physical property, regardless of the theory of jurists or engineers or economists."

C. R. Phenicie welcomed the delegates and urged accountants to help dispel the idea that householders are discriminated against by electric utilities in favor of power customers. Other speakers were J. E. Gray, auditor Wisconsin Power & Light Company; S. R. Hatch of the Milwaukee Electric Railway & Light Company, and C. B. Boulet of the Wisconsin Public Service Corporation.

D. W. Faber, Milwaukee, of the Wisconsin Public Service Corporation, was elected chairman of the Accounting Section, and Louis P. Smith of the Milwaukee Gas Light Company, was elected vice-chairman.

Canadian Court Follows Precedent Set at Washington

The Supreme Court of New Brunswick, Canada, handed down a decision on June 17 which reversed an order of the Public Service Commission of that province reducing electric rates and cutting the net revenue of the Moncton Tramways, Electricity & Gas Company, Ltd., by 20 per cent. A cross-appeal by the city was dismissed. The New Brunswick court held that the present-day replacement cost of labor and material, less depreciation, must be considered in establishing a rate base, thus following the trend of recent decisions by the United States Supreme Court. The old rates are to remain in force, according to the ruling.

The Moncton company is owned by the Pennsylvania Gas & Electric Company of New York, and the decision is held to have a bearing on the question whether utility investments in the Dominion are to prove attractive to United States capital.

New England to Make Study of Farm Power

For the purpose of studying the extension of electric power service to New England farms, a joint committee representing agricultural and power interests has been formed under the auspices of its New England Council, according to announcement made at Providence by Harry R. Lewis, chairman of the agricultural committee.

The committee, which was appointed by the agricultural and power committees of the New England Council, consists of Dr. Arthur W. Gilbert, Massachusetts Commissioner of Agriculture; George M. Putnam, president of the New Hampshire Farm Bureau; John W. Leland, former president of the Maine Federation of Agricultural Associations; F. A. Belden of the Edison Electric Illuminating Company of Boston, and Samuel Ferguson of the Hartford Electric Light Company.

Colfax Extension Ready

One Generator in New Unit of Duquesne Mine-Mouth Plant Scheduled to Start Before Long

SUBSTANTIAL completion of one of the two generators to be housed in the fourth plant unit of the Colfax mine-mouth station of the Duquesne Light Company of Pittsburgh is announced, and it will soon be started up. This plant unit will contain two 41,250-kw. single-cylinder Westinghouse turbo-generators and three Babcock & Wilcox boilers. Each of the latter will have 27,786 sq.ft. of heating surface, designed to operate at 275 lb. pressure and 650 deg. F. temperature and equipped for pulverized fuel, with three 15-ton Raymond mills, discharging by duplicate screw conveyors into any of the three pulverized-fuel bins, each serving one boiler. Current will be taken from the generators at 11,000 volts to a single common bank of three 31,400-kva. single-phase transformers connected on the high-tension side to a 66,000-volt bus on the roof of the power station.

In connection with the installation of this equipment it was necessary to extend the turbine room and electrical bay approximately 144 ft. in length, adding 1,691,712 cu.ft. to the main power station, and a similar extension to the boiler room will be involved. The estimated total cost of the fourth plant unit is $8,300,000. This includes foundation and river-wall work done between June, 1925, and April, 1926, when it was the intention to rush the unit to completion. While this preliminary work was in progress, however, a contract was negotiated for the purchase of 30,000 kw. of firm power from the West Penn Power Company for transmission over the 132-kv. line connecting the two systems. The contract covers the period from Sept. 1, 1926, to Sept. 1, 1927, and it led to the postponement of the date for completion of Unit No. 4, which would otherwise have been finished last fall. As things stand, the first new turbo-generator of 40,000 kw. net capacity (1,250 kw. being taken by the house service bus) is virtually complete; the second turbo-generator and the three new boilers are to be ready in November.

Impressive Funeral Services for Guy E. Tripp

Funeral services held on Friday morning, June 17, for General Guy E. Tripp, whose death was chronicled in these columns last week, were very largely attended. They took place at All Souls' Unitarian Church, New York City, where a simple ceremony was conducted by the minister, Dr. Minot Simons. Westinghouse offices and works throughout the country ceased operation for five minutes at 11 o'clock,

when the services started. The company's New York office remained closed all day.

Among the honorary pall bearers were Nicholas F. Brady, Matthew C. Brush, Newcomb Carlton, George B. Cortelyou, Paul D. Cravath, H. P. Davis, Philip G. Gossler, Major-General James G. Harbord, E. M. Herr, Samuel Insull, Thomas N. McCarter, W. L. Mellon, L. A. Osborne, H. Hobart Porter, Dwight P. Robinson, M. S. Sloan, Charles A. Stone, Gerard Swope, A. W. Thompson, Samuel M. Vauclain, H. H. Westinghouse and Major-General C. C. Williams. Delegations from a large number of clubs and associations attended, as did many leaders in financial, industrial and electrical circles in addition to those just listed.

Detroit Draws Electrical Engineers

Well-Attended Summer Convention of A.I.E.E. Carries Out Excellent Technical Program—President Chesney Reiterates Views on Standardization—Entertainment Novelties

SERVING as proxy for the Mayor, and devoting his remarks in large part to the electrical growth of his city, Alex Dow, president of the Detroit Edison Company, welcomed to Detroit last Monday the thousand delegates who attended the summer convention of the American Institute of Electrical Engineers, held at that city from June 20 to June 24 inclusive. Those in attendance came from all parts of the country, and they listened to a program of reports and papers which fully measured up to the high standard set by the program committee. Discussion of the papers was plentiful, though the comment was aroused that it might have been even better had more time for it been allotted and had all the delegates read the reports and papers in advance. An unusual feature of the entertainment provided was short flights in airplanes, and a demonstration of television was another attractive feature. A sail on the lake, sightseeing, sports and trips of inspection also served to vary the proceedings.

Twenty-five papers and seventeen committee reports were presented, which, with the discussions they provoked, will be abstracted next week. Section and branch delegates held their meetings in advance of the technical sessions, which started Tuesday and continued through Friday, occupying the mornings only and leaving afternoons and evenings for social events.

Retiring President C. C. Chesney, in his address, told of ideas acquired and problems observed during his term of office. As at the winter convention in New York, he emphasized the importance of standardization, amplifying his previously expressed views on how electrical standardization should be handled. Labor conditions, Mr. Chesney said, have made necessary repetitive production operations, which are possible only by standardization, to bring about lower production costs and leave a sufficient margin for wages. After reciting the motives behind A.I.E.E. standards, he declared that the constitution of the American Engineering Standards Committee permits it to function only as a co-ordinating body and not as a standards initiating body. Lack of financial support, the inertia of industry and lack of interest in standards by industrial groups have hindered progress. So long as the A.E.S.C. confines itself to its constitutionally defined functions, Mr. Chesney said that the A.I.E.E. would continue to lend this committee its unqualified support; but he expressed opposition to any attempt of the A.E.S.C. to formulate electrical standards. He also declared that it would be premature to combine all international standards under one committee now.

In closing, the president announced that he would recommend to the board of directors that a committee of seven be appointed, consisting chiefly of past-presidents, to report in six months on the following points: (a) The internal routine to be followed in handling electrical standards; (b) present and future status of the A.E.S.C. and A.I.E.E. regarding standards; (c) status of the International Electrotechnical Commission on standards making.

Bancroft Gherardi, newly elected president of the A.I.E.E., accepted the office as the highest honor that can be paid any man in the electrical profession and said he would endeavor to show his appreciation by his work for the A.I.E.E.

Homestead Mill Energized by Distant Relay Tube

A joint demonstration by the United States Steel Corporation and the Westinghouse Electric & Manufacturing Company showing the possibility of controlling large power machinery by infinitesimal electric currents was made last week during the assembly of the Association of Iron and Steel Electrical Engineers at Pittsburgh. The feat involved building a minute quantity of energy released at New York from the hand of E. H. Gary, chairman of the Steel Corporation, into great enough strength to energize the corporation's electrified steel plant at Homestead, Pa. This was accomplished by various electrical devices, with the aid of radio waves and land wires over the 400 miles separating New York and Pittsburgh.

JUDGE GARY STARTS DISTANT GENERATORS BY WAVING HIS HAND

A sphere which rested on Judge Gary's desk was lined with silver and in reality served as one plate of a condenser. The Knowles grid-glow tube to which the sphere was connected is the invention of a Westinghouse engineer and is probably the most sensitive current controller ever developed for practical use. It has a cathode and anode, with a wire grid between. A difference of electrical pressure was set up between cathode and anode by connecting them to a 440-volt circuit. The grid, which normally is insulated from ground, provided the control valve for the tube.

Empire State Commercial Men Confer at Elmira

Nearly 150 sales managers of New York State utilities met this week on Tuesday at Rorick's Glen, Elmira, for the annual meeting of the Commercial Section of the Empire State Gas & Electric Association. The program was organized around four major themes—home service, building residence load, farm electrification and the industrial market. Delegates were welcomed by F. H. Hill, vice-president of the Elmira Water, Light & Railroad Company, whose guests they were at this famous resort operated by the Elmira utilities. A. V. Jones, Buffalo, reported the results of a survey of the possibilities of electrical water-heating load based on test installations and recommended as the ideal electric water heater for the average home a 40-gal. to 60-gal. insulated tank with a 1,000-watt or 1,500-watt element equipped only with a thermostat.

Rural extensions are now being made in New York State at the rate of 5,000 miles per year, and the great need is that the use of the service be not retarded by the lack of information as to how the farmer should apply electricity to his tasks, C. H. Churchill, Jr., asserted. Earl Whitehorne challenged the sales managers to immediate action to meet the changing conditions of the market. Now that the end of large-scale house wiring has come, he said, the next phase in the development of the industry will depend upon increasing sales to existing customers. To accomplish this better-paid and more effective sales departments must be organized.

Three very full sessions embraced also compensation of salesmen, distribution of commercial accounts, selling and servicing of electrical refrigeration, building range load, house wiring, advertising, parallel operation with industrial plants and Diesel-engine competition. W. A. Morris, commercial manager of the Kings County Lighting Company, was elected chairman for the ensuing year, and John L. Haley, vice-president of the Adirondack Power & Light Company, vice-chairman.

Northwest Men at Salt Lake

Commercial Topics Predominate at Opening Sessions of Association's Well-Arranged Convention

MEETING for their twentieth annual convention, four hundred members of the Northwest Electric Light and Power Association held one of the most successful meetings in the history of the association at Salt Lake City on June 21 to 24. President D. C. Green, whose address aroused much praise, said that the light and power industry must renew its efforts to tell its story to the public to offset the destructive influence of political agitators and that dissemination of information through educated employees is more effective than the same facts told over the footlights by high-priced public relations experts.

President-elect H. T. Sands of the National Electric Light Association made a stirring denunciation of government or political ownership and traced the achievements of the light and power industry to prove that the nation has greatly benefited by private management of public utilities. He outlined the major problems before the N.E.L.A. and said that the discharge of the association's nation-wide responsibility rests with the geographic sections.

At the Wednesday morning session George C. Sawyer, chairman Commercial Section, told of a reorganization plan for the section which will make its work continuous and more effective through the succession of officers from year to year. Isabell Davie of the national women's committee then discussed its work and showed how its activities were to be made more effective through organization of women's clubs throughout the country. The excellent work of the Lighting Bureau in schooling central-station employees, jobbers' salesmen and contractor-dealers in the fundamentals of lighting during the past year in Portland, Spokane and Seattle was covered by Clark Baker of the national "Mazda" sales division of the General Electric Company.

The work of the Iowa Committee on Public Utility Information was discussed by Joe Carmichael, director of that committee, who told of the excellent work being done in his state through the schools and newspapers. He strongly emphasized the need for newspaper advertising and expressed the opinion that utilities that do not advertise refrain because they have nothing to advertise.

Refrigerator manufacturers are ready with a "quality" product, and the selling job is now largely up to central-station companies, either directly or through co-operation with dealers, declared George S. Jones, Jr., public utility division of the Frigidaire Corporation, Dayton, Ohio. "Selling Your Job" was the subject of an inspirational address by Ray W. Turnbull, Pacific Coast sales manager Edison Electric Appliance Company, who covered the requirements for successful selling and urged executives and sales managers to pay careful attention to selection of men and their sales plan if they expect results, as these factors reflect the ability of the men directing sales.

J. E. Davidson, chairman Commercial National Section, said that there is an awakening in the minds of executives of operating and holding companies to commercial possibilities and urged that the industry adopt a threefold program of selling electric ranges, selling refrigerators and refixturing. He urged geographic sections to tie in with the National Commercial Section and its selling plan. In Mr. Davidson's opinion a director of sales at N.E.L.A. headquarters would be invaluable in co-ordinating the activities of the geographic and commercial national sections.

Engineering and public relations sessions scheduled for the last two days of the convention promised to be full of interest. An excellent entertainment program was arranged under the direction of P. M. Parry, commercial manager of the Utah Power & Light Company, general convention chairman.

Four Groups Concentrate on Farm Service

Committee on Relation of Electricity to Agriculture, Society of Agricultural Engineers, Project Leaders and Specialists Foregather at Twin Cities

IN MINNEAPOLIS and St. Paul this week four groups of men held separate and joint meetings to discuss specific and mutual problems concerning rural electrification. A decision to hold the annual meeting of the national Committee on the Relation of Electricity to Agriculture in the same week and place as the annual convention of the American Society of Agricultural Engineers presented an opportunity to those interested in farm electrification to bring together two other groups as yet unorganized but already performing a large function in the practical working out of the rural service idea. These groups were the leaders of the experimental projects which the farm colleges of 23 states have been operating for various periods of time and rural service specialists of the 60 or more power companies that have already made definite provision for the development of electricity on farms.

The week opened with an excursion on Monday by 81 project leaders and central-station men to the experimental project at Red Wing, Minn., which has been described in former issues of the ELECTRICAL WORLD. On Tuesday there were parallel meetings of the project leaders, rural service specialists and national committee.

At the meeting of the national committee the present officers were re-elected — J. W. Coverdale, Cedar Rapids, Iowa, chairman; G. C. Neff, Madison, Wis., secretary and treasurer; E. A. White, Chicago, director, and Lee C. Prickett, Chicago, assistant director. The director's report recited the progress which had been made in the past year and contained much useful information and data.

The meeting of the project leaders was devoted to the interchange of information regarding methods and practices in university extension work along experimental rural service lines.

The rural service specialists' meeting was opened by G. C. Neff, acting for the national committee. Following a discussion of rates, E. R. Meacham turned the attention of his hearers to the two problems in rural electric service as he saw them. The first is concerned with getting new customers, and the second with building up load on services already installed.

Among points canvassed were the large outlay for equipment to which the farmer is now subject apart from any contribution by him to the cost of erecting transmission lines, the need of protecting him from unscrupulous contractors, the desirability of insurance companies making standard safety provisions in their policies on farm equipment, and the outstanding appeal to the rural resident of household conveniences and labor-saving appliances. Sales of merchandise to farmers, it was held, should follow the course taken by power companies in urban merchandising, the power company acting not as a competitor of independent dealers but as a leader to show them the way. Collection of information regarding applications of electric power on farms was declared to be a job insufficiently done, and the meeting passed a resolution recommending that the rural service committee of the N.E.L.A. gather, co-ordinate and publish such data in volume.

A report of the rural service proceedings at the convention of the American Society of Agricultural Engineers, which opened Wednesday morning at the Agricultural College of the University of Minnesota, will be given next week.

National Electrical Credit Men at Cleveland

Called to order by L. C. Loomis, regional director, the twenty-ninth annual convention of the National Electrical Credit Association, held at Cleveland on June 16 and 17, formed the occasion for addresses by President H. E. Wilkins, Col. Leonard P. Ayres, who discussed "The Trend of Business," and Jack North, president of the Cleveland Electrical League. Other participants in the program were Harry L. Grant of the Graybar Electric Company, who discussed distribution; Jerome C. Fisher, whose topic was a proposed uniform mechanics' lien law, and O. J. Condon, who spoke on "Use of the Service." The presidents of the five geographical divisions of the association—New England, New York, Middle and South Atlantic States, Central and Pacific Coast—gave six-minute talks. Secretary F. P. Vose acted as toastmaster at the annual dinner, and the usual amusement and sight-seeing events were successfully carried through.

Charles R. Oliver of the Wetmore-

Savage Company, Boston, was elected president; Benjamin P. George of the Beardslee Chandelier Manufacturing Company, Chicago, vice-president, and Mr. Vose was again made secretary and treasurer.

Inspect Conowingo Dam

Pennsylvania and Maryland Officials Join Utility Men and Engineers in Visit to the Susquehanna

STATE and county officials and legislators from Maryland and Pennsylvania, investment bankers, Philadelphia Electric Company stockholders, representatives of the Federal Power Commission and of state commissions, existing or prospective large consumers of power and well-known utility men and engineers from Philadelphia, Baltimore, New York and Boston, to the total number of 150 or more, participated in a trip of inspection on June 17 to the Conowingo hydro-electric development of the Philadelphia Electric Company on the Susquehanna River. The trip was made possible by special trains from Baltimore and Philadelphia provided by the Philadelphia company. On arriving at Conowingo visitors had the choice of walking and observing details or of riding in improvised observation cars made from flat cars and thus obtaining a more general idea of the development, for which Stone & Webster and the Arundel Company of Baltimore are the contractors. A view of the dam as it neared completion was printed in the ELECTRICAL WORLD for May 28, page 1132.

Midway on the mile-wide sweep of the dam Governor Ritchie of Maryland clasped the hand of E. T. Stotesbury, head of Drexel & Company, in a ceremony marking the final closing of the Susquehanna River by the giant concrete structure. Lunch was served in the construction headquarters main dining room and was followed by a brief speech of welcome by Walter H. Johnson, president of the Philadelphia Electric Company, who introduced Governor Ritchie. The Governor dwelt on electric power as the arch in the industrial structure and expressed his personal pride in having been officially connected with the Conowingo project, which, he said, would serve as a bond of union between the two states it bordered.

New Directors of the S.E.D. Take Office

The reconstituted board of directors of the Society for Electrical Development held its first meeting under the reorganization plan during the N.E.L.A convention at Atlantic City. At this meeting the new directors took office, including the president, managing director and chairman Commercial National Section of the N.E.L.A., the corresponding officers of the N.E.M.A., E.S.J.A. and A.E.I. and the chairman of the League Council. Howard T. Sands, president-elect of the N.E.L.A., was appointed a director to succeed R. F. Pack. A special committee was appointed to report to the directors on future activities, functions and official and staff personnel.

Pacific Coast Men Canvass Many Topics

Greater Recognition Is Asked for Commercial Men—Hydro-Electricity Maintains Its Rank in Power Production—Public Relations, Women's Work and Advertising

PRESIDENT-ELECT H. T. SANDS of the National Electric Light Association brought a message of accomplishment and encouragement from the Atlantic City convention to the Pacific Coast Electrical Association last week and prophesied great progress during the ensuing year in carrying the benefits of electricity into the home through greater sales effort. The Pacific Coast association, as reported on June 18, assembled at Santa Cruz, Cal., for a four days' session, with more than five hundred members in attendance.

The increasing importance of the commercial man was emphasized by H. K. Griffin, chairman of the Commercial Section, when he asked that not only executives but the entire industry accord to commercial men the same financial and co-operative support that has been accorded other branches of the industry. A co-operative plan of merchandising in which 96 retail electrical outlets in the San Joaquin Valley participate in the sale of ranges and socket appliances was outlined by H. H. Courtright, manager of the merchandising division of the San Joaquin Light & Power Corporation, before the Commercial Section. Under this plan electrical and non-electrical dealers in the company's territory are receiving the benefit of the power company's advertising and promotional work.

A. H. Markwart, vice-president in charge of engineering, Pacific Gas & Electric Company, said that, despite the decreasing cost of steam power due to the increased efficiency of steam electric generating plants, hydro-electric power will continue to play an important part in the power supply of the Pacific Coast. Mr. Markwart's conclusions were drawn from a study which he had made of the relative cost of steam and hydro energy under varying load factors.

The value to the industry of the several investigation projects being carried on by the N.E.L.A. headquarters staff was brought to the attention of Pacific Coast engineers by Major H. S. Bennion, director of engineering for the national association.

Arnold Pfau, consulting engineer with the Allis-Chalmers Manufacturing Company, Milwaukee, discussed characteristic features of present-day art in hydro-electric designs. He outlined the history of the development of hydraulic prime movers and presented a novel and interesting discussion of the operating theory of waterwheels, particularly the propeller type.

Paper-cable manufacture as an engineering problem was dealt with in detail by Dr. Robert J. Wiseman, research engineer for the Okenite Company. A continuation of the policy of power-company engineers in specifying the materials and manufacturing processes will seriously hamper the economic development and manufacture of underground cables, he declared.

The necessity for the commercial managers to "sell" themselves to their executives and show them by results the value of the commercial department was vividly portrayed by Ray W. Turnbull, Pacific Coast sales manager of the Edison Electric Appliance Company, who spoke at a luncheon on Wednesday noon.

In a forceful address by Dr. Paul F. Cadman, associate professor of economics at the University of California, on Thursday morning, he appealed to the power companies to make their advertising more human and decried the tendency of certain monopolistic industries to discount the value of advertising.

Clark Baker, Edison Lamp Works, outlined the program of the Lighting Bureau of the Pacific Coast association to introduce better lighting into the home through a plan similar to that pursued for several years in bringing the advantages of better lighting to business men by lectures and demonstrations before business men's clubs.

W. S. Vivian of the Middle West Utilities Company, Chicago, asserting that public relations activities should be definitely programmed if results are to be expected, showed how through employees' educational meetings the rank and file of his company were being trained to build public good will.

Addresses by Dr. Mariana Bertola, president of the California Federation of Women's Clubs; Miss Isabell Davie, of N.E.L.A. headquarters, and Miss J. Frances Emans, chairman of the California women's committee, dealt with the woman's point of view of industry problems and the work of the women's committee.

The development conference on Friday afternoon, a feature of these conventions, had as its speakers Leon O. Whitsell, a member of the California Railroad Commission; Earle Houghton, president California Farm Bureau; Robert Bentley, president California Packing Corporation, and Paul S. Clapp, managing director of the N.E.L.A. Commissioner Whitsell asserted that the commission's supervision of the financing of electric utilities has contributed materially to keeping down the cost of money necessary to their development and told of a policy to be established by the California commission of keeping an inspector on large construction jobs to make a detailed report to the commission for use in future rate cases.

A feature of the meeting was a three-minute speaking contest held at a luncheon on Tuesday noon, in which nine contestants who had won the right to represent their organizations in the finals held at the convention participated.

Officers elected for the ensuing year were: President, W. L. Frost, Southern California Edison Company; first vice-president, P. M. Downing, Pacific Gas & Electric Company; second vice-president, H. H. Kelly, Southern Sierras Power Company.

Purchases and Mergers

Southern Power Company Takes Over North and South Carolina Plants from Barstow Interests—Cincinnati Suburban Asks Leave to Sell—Numerous Other Transactions

THE General Gas & Electric Corporation, which is the W. S. Barstow holding organization, announced on June 17 that it had contracted to sell the properties of the North Carolina Public Service Company, which operates the electric power utilities in Greensboro, High Point and Salisbury, N. C., and has bought its power largely from the Southern Power Company, and the South Carolina Gas & Electric Company of Spartanburg, S. C., to the Southern Power Company. The properties changing hands include those formerly known as the Blue Ridge Power Company. In connection with this transaction the Southern Power Company has contracted to purchase approximately half of the energy generated from the Broad River Power Company's plant at Parr Shoals—a Barstow property—and the coming twenty-million-dollar plant of the Lexington (S. C.) Water Power Company on the Saluda River. The General Gas & Electric will in future concentrate its efforts in South Carolina on the building of this large plant and the further development of Parr Shoals. In connection with the above transaction the protracted suit of a few years ago between the Southern Power and North Carolina Public Service companies is recalled. This suit was occasioned by the refusal of the Southern Power to furnish power to the Greensboro company after the expiration of its original contract. The courts decided in favor of the Greensboro company.

Consummation of the purchase of the West Virginia properties of the Southern Cities Utilities Company by the American Water Works & Electric Company, as foreshadowed in detail in the ELECTRICAL WORLD for June 11 (page 1295), was announced at the end of last week.

The Cincinnati Suburban Power Company has applied to the Ohio Public Utilities Commission for authority to sell its property and business to the Union Gas & Electric Company, Cincinnati, for $451,000. The Cincinnati Suburban Power Company supplies electric service to Milford, Newton, Fayetteville, Owensville and surrounding territory.

Ownership of the Community Power & Light Company, through the acquisition of all its common stock, by the American Commonwealths Power Corporation is revealed in the annual report of the American States Securities Corporation, which was instrumental in forming the American Commonwealths Power. The American States Securities is headed by Frank T. Hulswit. The Community Power & Light, with headquarters in St. Louis, has as its subsidiaries the Arkansas Utilities Company of Helena, Ark.; the Community Power & Light Company of Texas; the Kansas Utilities Company of Fort Scott, Kan.; the Missouri Utilities Company of St. Louis; the New Mexico Utilities Company of Clovis, N. M., and the Texas Utilities Company of Plainview, Tex.

The New York Public Service Commission has granted the petition of the Georgetown Electric Lighting Company, Inc., for permission to transfer its franchises and plant to the New York State Gas & Electric Corporation.

Details are again said to be nearly complete in the plan to merge the Central Indiana Power Company and the Terre Haute, Indianapolis & Eastern Traction Company into the Indiana Electric Corporation, and the proposal will soon be submitted to the Public Service Commission of Indiana. It was referred to in the ELECTRICAL WORLD for Feb. 19, page 419. The companies entering the merger are controlled by the American Public Utilities Company, of which Samuel Insull is chairman and Martin J. Insull president.

The Central Illinois Public Service Company has asked the Illinois Commerce Commission for a permit to acquire the Pittsburg Light & Power Company in Williamson County.

The electric light plant and distribution system at Cumberland, Ky., have been bought by the Kentucky Utilities Company from the Cumberland Light Company. The town is on the Cumberland River, about 24 miles northeast of Harlan, in the heart of the coal region, and Cumberland is about 7 miles from the nearest of the company's lines. The electric utility there will be operated as a separate unit for the time being, yielding a yearly gross revenue of $10,000.

The Drake-Jones Company, Minneapolis, has taken over the power plant at Rolla, N. D. The Kelly Electric Company of Devil's Lake, N. D., has been sold to George Crook. The Otter Tail Power Company has purchased the electric systems in Rolette, Egeland, York, Bottineau, Munich and Milton, N. D. Milton and Munich were municipal towns.

The citizens of Bayfield, Wis., have voted, 135 to 100, for the repurchase of the hydro-electric plant which has been owned by the Northern Wisconsin Hydro-Electric Power Company since 1921. The Wisconsin Northern Light, Heat & Power Company has sold its electric line operated in the vicinity of Mosinee to the Wisconsin Valley Electric Company.

It is announced from the Charlotte offices of the Southern Public Utilities Company that the Anderson branch in South Carolina has purchased for $9,500 the franchise and distribution system of the Pendleton Electric Light Company, which supplies the towns of Pendleton and Sandy Springs and communities adjacent.

The Carolina-Georgia Power Company, of which Robert R. Livingston of New York is the head, has completed the merger of 22 ice plants and four oil mills in twenty Georgia and South Carolina cities, the properties being valued at between $3,000,000 and $4,000,000.

The Houston (Tex.) Lighting & Power Company has acquired the Freeport Light, Water & Ice Company with the exception of the latter company's plants at Bryan Mound and Hoskins Mound.

The Mayor and Selectmen of West Point, Miss., have received a flat offer of $300,000 for the water and light plant from the Mississippi Light & Power Company.

The San Joaquin Light & Power Corporation of Fresno, Cal., is planning to absorb the Midland Counties Public Service Corporation and thus acquire its distributing systems and franchises in San Luis Obispo County and parts of the counties of Monterey and Santa Barbara. Both companies are now controlled by the North American Company.

McKinley Brothers, Inc., who operate an electric plant at Middletown, Lake County, Cal., have applied to the California Railroad Commission for authority to sell the system to the California Telephone & Light Company for $9,000.

Announcement has been made that, subject to the approval of the California Railroad Commission, the Pacific Gas & Electric Company has entered into an agreement with the Vacaville Water & Power Company whereby the former company will take over the stock of the latter in exchange for preferred stock of the Pacific company.

The International Utilities Corporation has acquired the Rosetown Electric Light & Power Company, Ltd., of Rosetown, Saskatchewan, Canada, which is about 100 miles southwest of Saskatoon. The acquisition is said to be in furtherance of the general plan of the International Utilities Corporation to build a chain of electric light and power properties in the Western provinces of Canada. The International Utilities has also acquired the Watrous Electric Light & Power Company, in the Province of Saskatchewan, Canada. It serves Watrous, a railroad town, and Manitou Beach.

Volta Centenary Exposition Opens at Como

The exhibition at the Villa Olmo, Como, Italy, in commemoration of the first centenary of the death of Alessandro Volta, has been opened in the presence of the King of Italy, Signor Belluzzo, Minister of National Economy, and other prominent persons. Descendants of Volta were present.

The exhibition will remain open until October, and an international telegraph and telephone congress will take place in connection with it.

Among the most interesting contributions is one by Marconi, who has lent a valuable collection of apparatus, some of which was used in his earliest experiments, together with a number of transmitting and receiving instruments which were used in the early days of commercial radio before the development of the thermionic tube. These include replicas of the first experimental short-wave beam transmitter and receiver used by Marconi in his earliest experiments at his father's house at Bologna in 1895. It was with this apparatus that he demonstrated in Italy the possibilities of beam transmission and reception and in 1896 confirmed his results officially before representatives of the British Post Office.

Wolf River Project Again

Menominee Indians More Concerned with Compensation than Scenery —Other Commission Business

REPRESENTATIVES of the Menominee Indians were in Washington last week conferring with officials of the Federal Power Commission and of the Office of Indian Affairs on questions involved in the application of the Wisconsin Power & Light Company for rights on the Wolf River within the boundaries of the Indian reservation. The power company proposes to develop the entire head available in that part of the river. This project is just above the Shawano site for which the power company has applied for a license. The terms of a preliminary permit and the possible effects of the project were discussed. The attitude of the Indians appeared to be that the development should be allowed to proceed under conditions which would allow fair compensation to the tribe. The Indians asked to be heard when the terms of any license which may be issued are to be discussed. A representative of the power company explained that the company would not be willing to go ahead with the development on any terms unsatisfactory to the Indians. As previously reported, some opposition to the project is coming from those who fear that the scenic beauty of the river will be marred. The Indians seem to be unanimously of the idea that no such result would follow.

Walter L. Huber of San Francisco has applied to the commission for a preliminary permit covering a project on the North and Middle Forks of the American River near East Auburn, Cal. It is estimated that 155,000 hp. can be developed at that site. The water is to be used successively in two power houses.

The Telluride Power Company of Salt Lake City asks a license to cover a partly constructed project on Beaver River. It is planned to install 5,200 hp. The application also covers 217 miles of transmission line.

The Arizona Power Company of Prescott has applied for a license covering a transmission line from Mingus Mountain to Prescott.

International Paper Company Wants Newfoundland Power

Announcement that Armstrong, Whitworth & Company, the British armament firm, which recently reported extensive losses, proposed to sell its subsidiary, the Newfoundland Power & Paper Company, to the International Paper Company of New York was made at the annual meeting of the Armstrong company at Newcastle, England, recently. That negotiations between the two pulp and paper companies have been going on has been known for some time. The sale would involve the acquisition also of very extensive timber tracts in Newfoundland, and much opposition is said to have arisen, exciting apprehension on the part of the Newfoundland and British governments that the resources of the colony may be absorbed by American financial interests.

Briefer News

Nashville Railway & Light Valuation.—In a joint report issued by engineers of the Nashville Railway & Light Company and the Tennessee commission a valuation of $23,083,706 as replacement cost less depreciation has been arrived at. The original cost estimate was placed at $16,843,201 and the actual cost was reported at $17,542,054. Date for hearing before the commission has not yet been set.

Cleaning Up After a Prairie Storm.—One of the prairie "twisters," of which this spring has seen so many, demolished last month near Maryville, Mo., eight steel transmission-line towers, like the one shown here, of the United Light & Power Engineering &

Construction Company. The line damaged serves Barnard, King City, Guilford and numerous other towns. When news of the break in service was received, at 9:45 p. m., every available man was rushed to the scene. Holes were dug by lantern and flashlight, aided by the vivid lightning flashes. The black "gumbo" mud which stuck to everything made pole-raising difficult. In spite of all these handicaps daylight saw the poles in place with wires and insulators on them, offering some semblance of a transmission line. By noon of the next day, or fourteen hours after the storm broke, normal service was restored to these communities by the volunteer crew of ten men.

N. E. L. A. Lamp Committee to Circulate Film.—As a result of the presentation of the report of the lamp committee at the Atlantic City convention of the N. E. L. A. by means of a motion-picture film, the committee has already had a number of requests from central-station companies for this film, which they wish to present in their several communities. This demand has encouraged the lamp committee to consider an organized effort to circulate the film throughout the membership. It was shown in Boston and Cleveland this week, will be in New York next week, and Baltimore and other cities have also made requests for it. It is the tentative plan of the committee to issue an illustrated leaflet descriptive of the film, circulate it to the members of the N. E. L. A., through headquarters, and sell the film for a moderate price.

Public Service Company of New Jersey Gives $50,000 for Scientific Research.—An annual appropriation of $10,000 for the next five years for pure scientific research at Princeton University, made by the Public Service Electric & Gas Company of New Jersey, was announced by Dr. John Grier Hibben, president of Princeton, last week. Dr. Hibben said the appropriation will be used to further investigations in chemistry.

Utah Has Independent Colorado River Committee.—Organization of the Colorado River Fact-Finding Committee of Utah has been perfected through the efforts of the Utah State Farm Bureau and the Utah Associated Industries, with J. J. Burke, Salt Lake City engineer and contractor, as chairman. The committee will distribute pamphlets to Utah citizens outlining the result of its investigations into potential power and other phases of the Colorado River problem.

Collapse of Sewer Stops Power House.—On June 18 a large sewer emptying into the Ohio River at Evansville, Ind., caved in, and the accident forced the Southern Indiana Gas & Electric Company, which used the sewer for the discharge of great quantities of water, to close down. This cut Evansville off from power for nearly 24 hours. Street cars were unable to run and the large industrial plants in the city supplied with power from this company were forced to suspend operations, with heavy resultant losses. Repairs were promptly made.

Public Utility Advertising Association Meets in Denver.—Plans have been completed for the fifth annual meeting of the Public Utilities Advertising Association, which is scheduled to take place in Denver on Monday and Tuesday of next week, at the same time as that of the International Advertising Association. The meeting will be presided over by Frank LeRoy Blanchard, president of the Public Utilities Advertising Association and director of advertising and news of Henry L. Doherty & Company. After Mr. Blanchard's presidential address, Paul S. Clapp, executive director of the National Electric Light Association, will talk on "Why National Utility Associations Believe in Advertising."

New England Power Leaders Aid Industrial Survey.—Co-operating with the power committee of the New England Council, a committee headed by President Charles L. Edgar of the Edison Electric Illuminating Company of Boston is now at work on a study of industrial development promotion for the six Northeastern States. Other members of the power company committee are Martin J. Insull, president Middle West Utilities Company, Chicago; Samuel Ferguson, president Hart-

ford Electric Light Company; Henry I. Harriman, president New England Power Association, Boston, and W. Rodman Peabody, vice-president Turners Falls Power & Electric Company, Boston.

Youngstown Sheet & Tube Mills to Be Electrified.—Steam power will be replaced entirely by electricity in the main plant of the Youngstown Sheet & Tube Company at Campbell, Ohio, within the next year, according to announcement. The change will cost about $6,000,000. The present boiler plants, including the large blast furnace and Bessemer steam power houses, will be scrapped and in their place modern boilers of 400-lb. pressure and developing 2,000 hp. each will be installed.

Virginia Electric & Power Buys All Riparian Rights at Roanoke Rapids.—The Virginia Electric & Power Company has completed the purchase of all riparian rights at Roanoke Rapids, N. C., William E. Wood, president of the company, announces. The rights, which, it is understood, cost approximately $500,000, consist of those formerly owned by the Roanoke Mills and the Roanoke Fibre Board Company. The present hydro-electric plant can utilize this additional water power in full. The mills are to be converted to electrical operation.

Founder of Worcester "Tech" Honored.—Through the gift of the class of 1922, a bronze tablet set in a granite rock on the village green at Mason, N. H., was dedicated June 17 to the memory of John Boynton, a tin peddler who founded the Worcester Polytechnic Institute in 1865. Prof. Charles J. Adams accepted the tablet on behalf of the institute and presented it to the town of Mason, the birthplace of Mr. Boynton. An audience of about 200, including engineers educated at Worcester, class members and guests, witnessed the ceremonies.

Houston Lighting & Power Company Spending $4,730,000.—In an article recently written Charles J. Kirk, public service commissioner of the city of Houston, Tex., traces the development of the Houston Lighting & Power Company from its beginning to the present year in a highly appreciative way, concluding with a table covering the company's proposed improvements and extensions in the current year. These are to cost $4,730,700, the largest item being $2,200,000 for a new turbo-generator at the Deepwater station. Substation expenditures, transformers and transmission and distribution extensions account for most of the balance.

Hydro Project for the Imperial Valley.—Final approval of plans for the development of hydro-electric power at five locations on the Imperial Irrigation District canal system in Imperial Valley, California, at a cost of approximately $1,600,000, has been given by the directors of the district, following a report made by M. J. Dowd, engineer for the district. Mr. Dowd said that he can begin delivering power within nine months after the money is available and that the cost will be at least 30 per cent lower than is now paid to private companies. The engineer was authorized to present his plans to the Bond Certification Commission of the state. If permission is granted, it is planned to hold a bond election to authorize the issuance of securities. No authorized opposition to the project has appeared, but a number of landowners have indicated that they will fight the proposal on the ground that the passage of the Swing-Johnson bill will open power possibilities much more feasible. The Imperial Valley is served electrically by the Southern Sierras Power Company.

Coming Meetings of Electrical and Allied Societies

North Central Division, N.E.L.A.—Lake Superior steamboats from Duluth, June 24-28. J. W. Lapham, 351 Loeb Arcade, Minneapolis.

Michigan Electric Light Association—Grand Hotel, Mackinac Island, July 5-7. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

East Central Division, N.E.L.A.—Cedar Point, Ohio,, July 12-15. D. L. Gaskill, Greenville, Ohio.

Association of Electragists International—Hotel Chase, St. Louis, Aug. 8-12. L. W. Davis, 15 W. 37th St., New York.

International Association of Municipal Electricians—Salt Lake City, Aug. 16-19. E. H. Benz, West New York, N. J.

Camp Co-operation VII—Association Island, Henderson Harbor, N. Y., Aug. 28-31. Society for Electrical Development, 420 Lexington Ave., New York.

New England Division, N.E.L.A.—New London, Conn., Sept. 12-15. Miss O. A. Bursiel, 20 Providence St., Boston.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Sept. 13-16. F. L. Hutchinson, 36 West 39th St., New York.

To Build 265 More Miles of Transmission Line in Texas Oil Country.—The Oil Belt Power Company of Eastland, Tex., a subsidiary of the Southwestern Power & Light Company, is to build 265 miles of transmission line to radiate from its plant near Eastland, in which an additional 15,000-kw. turbo-generator with auxiliary equipment will be installed.

New Unit Goes Into Service at Waukegan.—The generating capacity of the Waukegan (Ill.) station of the Public Service Company of Northern Illinois has been nearly doubled by the installation of a 50,000-kw. turbo-generator, which was put into service on June 4. This unit (No. 3) supplements No. 1, rated at 25,000 kw., and No. 2, rated at 35,000 kw. It was built by the Allis-Chalmers Manufacturing Company, is of compound-tandem type and, with its boilers and auxiliaries, is of the latest design. It operates at 600 lb. pressure and is expected to turn out a kilowatt-hour on 1.3 lb. of coal.

Public Service Company of Oklahoma Will Have New Building.—A new six-story building on which construction will start in two months is to be erected by the Public Service Company of Oklahoma at Sixth and Main Streets in Tulsa. An 80-ft. x 140-ft. tract has been purchased for this purpose. Detailed plans are being worked out. Tulsa is now general headquarters for all the 75 cities and towns served by the Public Service Company, although headquarters for the management of properties included in the Oklahoma Power Company purchase will still be maintained at Okmulgee.

Testing Cushman Plant Generators.—Tests of the turbo-generator sets of the Cushman power plant, belonging to the city of Tacoma, Wash., to determine their degree of efficiency have been satisfactorily concluded, according to city light department engineers. Results of the tests will not be known until August, when E. A. Taylor of the Worcester (Mass.) Polytechnic Institute will report. It took fifteen men more than four days to make 550 separate observations, and twelve men worked one day on computations. The tests were conducted under Alvin F. Darland of the city department of plant extensions.

Metropolitan Electrical League of Boston Elects New Directors.—Nearly a hundred members of the Metropolitan Electrical League of Boston listened at a meeting last week to an address on the commercial outlook before the electrical industry by Earl Whitehorne, commercial editor ELECTRICAL WORLD, who was made an honorary member of the league. O. L. Hawes, J. P. Alexander, J. P. Kobrock, J. T. Day and L. C. Billings were elected new directors. Leavitt L. Edgar, vice-president Edison Electric Illuminating Company of Boston, is chairman of the board of directors. President George H. Wahn occupied the chair at the meeting.

Extension of Railroad Electrification in Mexico.—An additional 18-mile stretch of the Mexican (Vera Cruz) Railway is to be electrified, the contract for the equipment having been awarded to the General Electric Company. The tract which is to be electrified is between Cordova and Paso del Macho, through the mountains. The plans also involve the construction of an electric power plant at El Potrero. More than a year ago the first short division of this railroad was converted to electric traction, and results of a highly satisfactory kind are reported. The line is owned by British interests and runs between Mexico City and Vera Cruz, 264 miles.

"White-Way" Boulevard Up Lookout Mountain Dedicated.—A parade from Chattanooga, including the Governor and Senators of Tennessee and other prominent men from both within and without that state, wound up Lookout Mountain on the evening of Monday, June 13, to dedicate the "white way" that now illuminates that historic ascent. Two days of festivities followed, the brilliantly lighted boulevard being hailed on all sides as the precursor of development and progress based largely on electricity. Governor Peay spoke strongly for the generation of energy from the latent water powers of the upper Tennessee River. The Tennessee Electric Power Company furnishes the energy for the installation, and its engineers arranged for the completely automatic turning on of the current, Secretary of Agriculture Jardine pressing the actuating switch at Washington by request of President Coolidge, who had left for South Dakota.

Men of the Industry

E. W. Brown Appointed Chief Engineer of Kentucky Utility

Edward W. Brown has been appointed chief engineer of the Kentucky Utilities Company and its subsidiaries to succeed George T. Bogard, who was made vice-president and chief of operations, as previously announced in the ELECTRICAL WORLD. Following the close of his collegiate career, Mr. Brown was employed successively by the Westinghouse Electric & Manufacturing Company, the General Electric Company and the Central Illinois Public Service Company. He joined the Kentucky Utilities Company in September, 1917, was plant superintendent at Pocket, Va., until 1920, later superintendent of operations and then district engineer.

Gerard Swope, president of the General Electric Company, has been awarded the honorary degree of doctor of laws by Colgate University.

Dr. Irving Langmuir, assistant director of the research laboratory of the General Electric Company, has been awarded the honorary degree of doctor of science by Kenyon College.

F. B. Odlum, a vice-president of the Electric Bond & Share Company, New York, has been elected a vice-president of the Electric Bond & Share Securities Corporation.

Colonel R. H. Morse, of Fairbanks, Morse & Company, Chicago, returned June 19 from abroad on the Red Star liner *Belgenland,* following a six months' tour around the world.

Dr. W. R. Whitney, director of the research laboratory of the General Electric Company, has been awarded the honorary degree of doctor of science by the University of Michigan.

Arthur W. Thompson, president of the United Gas Improvement Company, Philadelphia, was awarded the honorary degree of doctor of science by the University of Pennsylvania at the recent commencement exercises.

W. F. Ficklen, of Hazard, Ky., has been made manager of the Appalachian Electric Power Company at Huntington, W. Va., succeeding the late C. S. Dawson. As manager Mr. Ficklen will have entire charge of the company's property and operations in what is known as the Charleston district, which includes Huntington. For several years Mr. Ficklen has been stationed at Hazard, in charge of the eastern Kentucky coal-field operations of the Kentucky & West Virginia Power Company. Mr. Ficklen is well known in the Virginias.

Elmer A. Sperry, inventor and engineer, was awarded the honorary degree of doctor of science by Lehigh University at the recent annual commencement exercises. Mr. Sperry has long been an outstanding figure in the electrical industry, having been one of the founders of the American Institute of Electrical Engineers and of the American Electrochemical Society and chairman of the committee that called the first meeting of the National Electric Light Association. The author of many papers and addresses delivered before engineering and technical societies, he has to his credit more than four hundred patents on electrical and mechanical devices. Mr. Sperry is president of the Sperry Gyroscope Company, Brooklyn, N. Y.

F. J. Howes Consulting Engineer for Rochester Utility

Franklin J. Howes, for the past five years chief engineer of the Rochester Gas & Electric Corporation in charge of design, construction and operation of the company, has been promoted to the position of consulting engineer. Mr. Howes has been affiliated with the Rochester company since 1908, when he entered its employ in the capacity of assistant to the mechanical and electrical engineer. His unusual capability

F. J. HOWES

and devotion to the duties imposed upon him attracted the attention of the company's executives, and in 1915 he became head of the engineering department. During his occupancy of this office Mr. Howes was frequently called in consultation on problems concerning water-power investigation, valuation, design and construction.

Mr. Howes was born in Iowa in 1880 and is a graduate of the University of Michigan. Previous to his affiliation with the Rochester Gas & Electric Corporation, he had been identified with the H. Mueller Manufacturing Company at Decatur, Ill., and had spent three years as assistant on the engineering staffs of the Utah Copper Company at Bingham, Utah, and of the Scantic Mining & Milling Company at White Cross, Col.

E. R. Crofts, formerly purchasing agent for the company, was appointed chief engineer to succeed Mr. Howes, and **George B. Histed,** assistant superintendent of the construction department, was promoted to be superintendent of the department.

Ernest V. Pannell, technical adviser to the British Aluminium Company, Ltd., London and New York, has left on a business trip for London, where he will spent two or three months.

Roderick McRae, formerly superintendent at Lewiston, Idaho, for the Pacific Power & Light Company, has been appointed district manager at Hood River, Ore.

William E. Wickenden, director of investigation of the Society for the Promotion of Engineering Education, was awarded the honorary degree of doctor of engineering by the Worcester Polytechnic Institute at the commencement exercises held June 20.

Harold T. White of White, Weld & Company, New York, has been elected chairman of the finance committee of the Washington Water Power Company, succeeding his father, the late W. A. White. Henry L. De Forest was elected secretary of the committee.

A. H. Moore, chairman of the standardizing committee of the General Electric Company, has retired and **S. H. Blake** has been appointed to succeed him. Mr. Moore will relinquish his duties Aug. 1 on account of ill health after 39 years of service with the General Electric Company and its associated foreign manufacturing companies. Mr. Blake will succeed Mr. Moore as chairman of general and other standardizing committees.

Donald Ross, one of the assistants of the late Henry P. Davison, of J. P. Morgan & Company, in the conduct of the American Red Cross during the war, has become vice-president in charge of finance of the Splitdorf-Bethlehem Electrical Company. As assistant secretary of the war-time Red Cross, Mr. Ross gained nation-wide prominence in connection with his handling of the allocation of more than $300,000,000 appropriated by the War Council for Red Cross activities.

Roy M. Godwin, safety director of the Northern Indiana Public Service Company, has resigned and has left for Norristown, Pa., where he will hold a similar position with the Philadelphia Suburban Counties Gas & Electric Company. Mr. Godwin was formerly identified with the United Gas Improvement Company of Philadelphia, owner of the Counties Gas & Electric, for nine years. This company formerly operated the Northern Indiana Public Service Company. As safety director for the Northern Indiana company, Mr. Godwin spent five and one-half years in Fort Wayne. He was active in Chamber of Commerce work and especially prominent in safety work in the city and schools.

D. J. Guy, who has been connected with the Federal Power Commission since 1920, has entered the natural resources production department of the Chamber of Commerce of the United States to give special attention to hydro-electric power development. Mr. Guy has a broad background of technical training and actual experience in the hydro-electric branch of engineering. Following graduation from the Massachusetts Institute of Technology in 1912, he affiliated himself with Stone & Webster, engaging in hydro-electric construction work in Washington and California. After spending some time as professor of engineering and mathematics at Whitworth College he entered

the employ of the United States Geological Survey on water-power investigation. In his new position Mr. Guy will devote his attention to water resource problems and other developments related to electric power supply and use.

Jack B. Silverman, formerly connected with the Louisville Gas & Electric Company, Louisville, has removed to Cincinnati to join the Columbia Engineering & Management Corporation.

James J. Phelan of Hornblower & Weeks, Boston, has been elected a director of the New England Power Association.

W. L. Mellon, president of the Gulf Oil Corporation, has been elected a director of the Westinghouse Electric & Manufacturing Company, succeeding Robert Mellon, president of the Mellon National Bank.

Howard E. Way has been appointed assistant chief of the electrical equipment division of the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

Chester W. Rice, who has been engaged in development work in the research laboratory of the General Electric Company, has been named assistant to E. W. Allen, vice-president in charge of engineering. Mr. Rice will give special attention to new developments.

Earl J. Biegel, formerly chief division inspector for the Westchester Lighting Company, Mount Vernon, N. Y., has been made assistant superintendent of the electric distribution department of the Memphis (Tenn.) Power & Light Company.

Dr. William D. Coolidge, assistant director of the research laboratory of the General Electric Company and discoverer of the cathode ray, was made the recipient of the degree of doctor of science by Lehigh University at the recent annual commencement exercises. Union College also honored Dr. Coolidge with the same degree.

Abel Reynolds, for many years secretary to the general manager of the Narragansett Electric Lighting Company, Providence, R. I., has been appointed superintendent of the Bristol County Gas & Electric Company, with headquarters at Bristol, R. I., an affiliated organization. Mr. Reynolds joined the forces of the Narragansett company in 1899 and has had a long and varied career in its service. He succeeds **Albert G. Earle,** who retired May 14 after 32 years of continuous service with the Bristol company. Mr. Earle's preliminary training was obtained with the Brush Electric and Thomson-Houston organizations, and he had been superintendent of the Bristol company since 1898.

F. Malcolm Farmer, chief engineer of the Electrical Testing Laboratories, has received a signal honor for his paper on "Tests of Paper-Insulated High-Tension Cable," presented at the regional meeting of the American Institute of Electrical Engineers at Madison, Wis., May 7, 1926. The committee on awards reported to the board of directors of the Institute that this paper was the one chosen, in accordance with annual custom, as the "national best paper" and also the "national best regional paper" for the year 1926. An award is granted annually by the Institute for each of these papers separately, as determined by the committee, but in this case one paper won both awards.

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, was awarded the honorary degree of doctor of science at Rutgers University on June 11. In his citation of Mr. Edgar President J. M. Thomas said: "Electrical engineer, honored and loved executive of important electrical organizations, a leader throughout the period of its greatest development of that industry of many miracles which has multiplied human efficiency and notably enriched our common life: your Alma Mater, on this forty-fifth anniversary of your graduation, for the distinction you have conferred upon her and for the deep affection which her scattered sons bear toward you, confers upon you the degree of doctor of science." On Monday of this week Mr. Edgar also received the degree of doctor of laws from Tufts College.

Obituary

John T. Pratt, financier and philanthropist, died suddenly June 17 in New York. Mr. Pratt, who inherited one of the largest fortunes built up in America in the past 25 years through Standard Oil affiliations, was himself a large stockholder in Standard Oil companies, though he did not partake actively in the management of these organizations. He practiced law, subsequently entering the railroad and financial fields. He served on the directorate of the J. G. White Management Corporation and J. G. White & Company. Mr. Pratt was born in Brooklyn, N. Y., and received his education at Adelphi Academy, Amherst College and Harvard University.

John M. Goodell, for a number of years editor of the *Engineering Record,* one of the papers later combined to form the present *Engineering News-Record,* a McGraw-Hill publication, died June 21 in New York. Mr. Goodell was graduated from the Worcester Polytechnic Institute and soon after graduation joined the editorial staff of the *Engineering News.* From the early nineties to 1912 he was identified almost continuously with the *Engineering Record.* Subsequently he engaged in consulting work and recently edited the *Journal of the American Water Works Association.* Latterly Mr. Goodell had been connected with the Babcock & Wilcox Company in charge of publicity and advertising.

Percy Warner, developer of Tennessee's electric public utilities and iron resources and prominent in the civic life of Nashville, died at his home in that city June 18, in his sixty-sixth year. Though his early connections were with the iron mining and smelting industry, Mr. Warner's principal business interests of recent years had been in the development of Southern hydro-electric power. In 1880 he entered the mining field with his father and brother, obtaining his first experience in Hickman County. After several years of successful pioneering in the iron business, he left that industry and became interested in the development of street railways, his investments being made in Chattanooga, Birmingham and Nashville. In 1902 he became receiver for the Nashville system, and one year later he effected a reorganization by which the Nashville Railway & Light Company was created. Mr. Warner became president, retaining that position until 1914. Since that date he had been identified with many utility properties in Memphis, Knoxville, Birmingham, Little Rock, Houston and New Orleans. He served as chairman of the Tennessee Public Utility Information Committee and was also on the directorate of the National Power & Light Company.

Charles F. Rand, mining engineer and formerly chairman of the executive board of the Engineering Foundation, died at his home in West Orange, N. J., June 21. Mr. Rand, who was 70 years of age, was one of the outstanding contributors to post-war research work in American industry. He was, perhaps, most widely known as the operator of manganese and copper-ore mines in the United States, though he was also identified with the construction of railways and the operation of iron mines in Cuba. He was formerly president of the American Institute of Mining and Metallurgical Engineers and held membership in the American Iron and Steel Institute, the American Society for Testing Materials and the National Research Council.

James Hay Reed, eminent jurist and vice-president and a member of the board of directors of the Philadelphia Company, Pittsburgh, died June 17 in his seventy-fourth year as the result of influenza. Senior member of the law firm of Reed, Smith, Shaw & McClay, Judge Reed achieved singular distinction as a leading figure of Pittsburgh in legal, financial, public utility, railroad and philanthropic circles. He organized the public utilities of Pittsburgh which are at the present time grouped under the Philadelphia Company, of which he was head for many years. Adviser to Andrew Carnegie, he was one of the organizers of the United States Steel Corporation and a member of the first board of directors. He organized the Pittsburgh, Bessemer & Lake Erie Railroad and also the Union Railroad. In addition, he was prominently identified with banking and insurance interests and was active for many years in private and public philanthropies. Judge Reed was born in Pittsburgh, obtaining his elementary education in the public schools of his native city and later attending the old Western University of Pennsylvania, now the University of Pittsburgh. It was in 1899 that he prepared the charter and other preliminaries to the organization of the Consolidated Gas Company of Pittsburgh, and after this and other companies had been acquired by the Philadelphia Company he became president of the consolidated interests. He retired as president in 1919, but continued his connection with these enterprises as senior vice-president and director.

Recent Court Decisions

Damages of $23,000 in Case Where Boy Was Badly and Permanently Injured by Electricity Not Excessive.—In Dziak vs. Swaney a jury awarded $20,000 damages to an eleven-year-old boy and $3,000 to his parents for permanent and very severe injuries sustained when a steam shovel collided with a guy wire and caused two poles of an electric power company to fall, the boy without fault of his own receiving a heavy charge for half an hour before he was rescued. The Supreme Court of Pennsylvania has refused to find the award excessive, holding that, though high, it could not be construed as proving the jury to have acted from prejudice or sympathy. (137 At. 228.)*

Misuse of Municipal Utility Funds in Advertising Condemned. — Municipal utility funds may not be used in advertising to persuade voters to authorize bond issues for extensions to such utilities, according to a decision of the California Supreme Court in the case of W. W. Mines, a taxpayer, against the Board of Water and Power Commissioners of Los Angeles. The court ordered the Los Angeles board to return to the city treasury $12,415 spent in advertising, banners and other publicity methods urging the passage of a thirty-five-million-dollar bond issue in 1922. A great part of this bond issue was intended to be used for the purchase of portions of the Southern California Edison Company's electric distribution system in territory annexed to the city.

Contracts for Electrical Equipment in Nebraska Municipal Plants Must Be Submitted to Bidding.—The Nebraska Supreme Court has denounced as illegal the practice of city councils making contracts with electrical equipment companies for building or reconstructing generating plants without first advertising for bids. This decision was made on the appeal of taxpayers of the city of Sutton from a district court order validating the acts of the City Council in making a contract with Fairbanks, Morse & Company for changing the municipal plant from a direct-current to an alternating-current type. The voters had previously authorized the change. The Supreme Court, in permanently enjoining the execution of the contract, said that, while there was no corruption alleged or proved in this case, it was clearly under Nebraska laws a wrongful exercise of power to give the contract to Fairbanks, Morse & Company when others stood ready to bid for several thousand dollars less. The court also maintained the right of taxpayers to enjoin illegal expenditures without showing any interest or injury peculiar to themselves as individuals when, as in the case of electric rates, they would indirectly pay for blunders.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Compensation Granted for Perpetual Power Right of 24 Years' Standing.—Suing on a perpetual power right granted 24 years ago, heirs of Christine Anderson have obtained a verdict of $6,510 against the Otter Tail Power Company in the district court at Fergus Falls, Minn. The Andersons sold a site for a dam 10 miles north of that place to a group of Fergus Falls men, with an agreement that if a dam were ever constructed, 20 hp. was to be furnished perpetually for use on the farm. In 1924 the power company, planning a dam 2 miles downstream, bought the site, but nothing was said concerning the power right. The dam site was flooded and the suit resulted. The power company contended that rights in the premises had been lost because the dam was never built.

Technical Objections to Commission's Grant of Right of Eminent Domain Overruled.—In sustaining the right of eminent domain granted by the Pennsylvania Public Service Commission to the Philadelphia Electric Company for a high-tension line in the outskirts of Philadelphia against the protest on technical grounds of H. L. Wilson, a property owner affected, the Superior Court of Pennsylvania said that the commission was not required to pass upon the question whether the necessary consent of the city to cross public streets had been obtained, nor was the omission in the company's petition of a description of the entire tract of land a vital matter inasmuch as a blueprint showing the entire tract was attached to the petition and made part of it. The court, however, declared that the landowner's appeal should not be quashed because of his attorney's passive receipt of an unsolicited bond that was tendered by the electric company to compensate for damages.

Irrelevant Testimony in Damage Suit, Calculated to Influence Jury, Causes Superior Court to Reduce Damages.—In Martin vs. Pacific Gas & Electric Company the plaintiff alleged and defendant did not deny that serious bodily injuries to the plaintiff, a boy, were due to the company's negligence in allowing a fallen wire to remain, charged, across a sidewalk for several hours, in a location where the plaintiff without negligence of his own came into contact with it. The case went to the jury solely on the issue of the extent of damages, and $25,000 was assessed. The District Court of Appeal of California affirmed the judgment on condition that the damages be reduced to $15,000, finding that irrelevant testimony, calculated to influence the jury, had been admitted, such testimony detailing alleged prior acts of negligence on the part of the company in constructing and maintaining transmission lines and having a tendency to obliterate in the jury's mind the distinction between punitive and compensatory damages. Testimony as to problematical conditions, such as cancer, that might result from the boy's injury was also declared improper by the Court of Appeal, in the absence of allegation that such results would necessarily follow. (255 Pac. 284.)

Commission Rulings

Alternating-Current Supply Made Requisite of Good Service.—The fact that an electric utility neglects or refuses to supply alternating current establishes a condition of public necessity and convenience, according to the ruling of the Oregon Public Service Commission. This decision was rendered in the matter of an application filed by J. C. Leith for a certificate to operate in a field already occupied by the Gold Beach Electric Company. The application was suspended pending the results of a further and separate order requiring the utility now in the territory to make provision for supplying alternating current within 90 days. Failing to supply this current, the applicant will be authorized to do so.

Commission Must Be Governed by Court Decision Affecting Matter at Issue.—In granting to the West Penn Power Company authority to acquire a right-of-way for a transmission line over and across the tracks of an electric railway company, the Pennsylvania Public Service Commission, having first asserted that the laws gave it jurisdiction in the matter, pointed out that the right asked had been already affirmatively determined by the Court of Common Pleas and said: "We are of the opinion that it is incumbent upon us to follow this determination until it has been reversed by an appellate court. . . . An order will, therefore, issue refusing the petition of the Westside Electric Street Railway Company to dismiss the application and approving the application."

"Going Concern" Value Again.—In fixing a figure of $30,000 to represent "going concern" value for the electric department of the Plattsburg Gas & Electric Company as against $100,000 asked by the company, the New York Public Service Commission said: "What is known as 'going concern' value is now generally held by the courts as an element to be included in the valuation of a public utility. Its definitions are numerous. . . . Going value is, therefore, something which the company acquires from being an established functioning unit, properly managed and operated, and it is not dependent upon the good or ill will of the community toward it. Again we are reminded that this commission is a fact-finding body and must follow the authoritative decisions of the courts when they have set forth the principles upon which our decisions must rest. Therefore a figure for going value must be determined in this case. No hard and fast mathematical formulas are required to be applied, nor do we feel that the 'past deficiency' method of arriving at a figure is the correct procedure. We are persuaded that a reasonable figure arrived at by considering the circumstances and conditions in each case should be allowed, and an element of judgment must enter into its fixation."

Financial and Statistical

Bond Market Recovers

Common Stocks Quiet

Ten-Point Rise in Half Year

MARKET weakness arising out of the announcement that brokers' loans had reached a new high record affected utility stocks less than any other group. Several slight declines were registered, but losses were almost immediately recovered. The twenty power and light common stocks listed on the New York Stock Exchange eased only a fraction of a point. Utility stocks on the curb and unlisted markets have been unusually quiet, as have most issues in the various other markets.

Less congestion exists in the bond market than was the case a fortnight ago. Better-grade utility issues are again in active demand and prices are firm. Some large issues are coming forward this week, and it may be assumed that the market is receptive.

The half year just completed has seen a steady and substantial upward movement in utility common stocks and a corresponding trend in preferred stocks and bonds. The index of common stocks computed by the ELECTRICAL WORLD rose ten points from 95 at the first of the year to 105 this week; the preferred average has risen three points, from 94.5 to 97.5, and the bond index has moved up one and one-half points, from 101.3 the first week of January to 102.8 this week.

Utilities Refund $56,000,000 in Bonds

Electric light and power companies in the United States have called bonds to the amount of $55,830,100 during the month of June. The companies involved, along with the amount outstanding and the date of maturity, follow:

Issue	Due	Amount
American Public Service, 6s	1942	$8,308,900
American Public Service, 5s	1942	5,813,400
American Public Service, 5½s	1942	1,864,400
American Public Service, 6½s	1942	1,225,000
Los Angeles Gas & Electric, 7 Bs	1931	3,500,000
Los Angeles Gas & Electric, 7 Cs	1931	1,500,000
Northwestern Public Service, 6½s	1948	3,274,600
Louisiana Power, 1st 6s	1944	2,250,000
West Missouri Power, 6s	1943	1,350,000
Community Power & Light, 5½s	1955	1,250,000
Tennessee Electric Power, 6½s	1933	1,000,000
Tennessee Electric Power, 6½s	1939	1,000,000
Northwestern Public Service, 7s	1933	950,000
Philadelphia Sub. Gas & Elec., 6s	1969	844,500
Red River Valley Power, 6½s	1944	700,000
Laurentian Hydro-Electric, 6½s	1934	500,000
Keene Gas & Electric, 5s	1935	168,500
Afton Wtr., Lt., Ht. & Pwr., 6s	1944	100,000
Wisconsin Hydro-Electric, 6s	1949	912,000
Columbia Gas & Electric, 5s	1928	18,684,000
Keystone Power, 7s	1934	600,000
Philadelphia Electric, 5½s*	1947	34,800

* Not entire issue.

Philadelphia Company Declares Stock Dividend.—The Philadelphia Company has declared a stock dividend of one one-hundred-and-twentieth share in common stock on the common and the regular quarterly dividend of $1 on the common, both payable July 30 to stock of record July 1. The company has also declared the regular semi-annual dividend of $1.25 on the 5 per cent preferred of $50 par, payable Sept. 1 to stock of record Aug. 10.

American Light & Traction Declares 50 per Cent Dividend.—Stockholders of the American Light & Traction Company on June 2 increased the authorized common stock from $40,000,000 to $100,000,000, par $100, and also ratified the declaration of a 50 per cent dividend payable in common stock on or after June 20 to common stockholders of record on such date as may be fixed by the directors.

Bids Made for Laclede Stocks.—Stockholders of the Laclede Power & Light Company have received an offer of one and one-third shares of Utilities Power & Light Corporation 7 per cent preferred, or four shares of Utilities Power & Light class A stock, or $128 a share in cash, for each share of Laclede Power common stock. Laclede Power & Light took over the electric business of the Laclede Gas Light Company early this year.

Voting Trusts in New England Oppose Buying by Outsiders

Shareholders Consider This the Simplest Method of Retaining Ownership and Control of the Utility Companies in Their Own Hands

BY BOWEN TUFTS
Vice-President C. D. Parker & Company, Inc.

Opposing interests are seeking to determine the future ownership and control of New England's public utilities. Outsiders are waging an active buying movement. Certain insiders are forming stock-depositing trusts to perpetuate present control. A viewpoint held by the latter group is here presented by Mr. Tufts. Other phases of the situation will be discussed in subsequent issues.

CONSERVATIVE legislation, conservative state regulation and conservative management of the electric power and gas companies of Massachusetts have been well known for many years among investors, bankers and utility company managers throughout the country. In the last year or two the results of these policies have become very apparent, as utility companies of Massachusetts have, almost without exception, been able to make satisfactory voluntary reductions in prices to the public and have been able to extend their lines and mains, not only in the congested sections of the cities and towns they serve, but also to the rural districts, where the farmers and the summer residents have been able to enjoy the many benefits from this service for lighting, heating and power purposes. The variety of these practical uses is estimated to be well over one thousand different uses for electricity and an additional thousand different uses for gas.

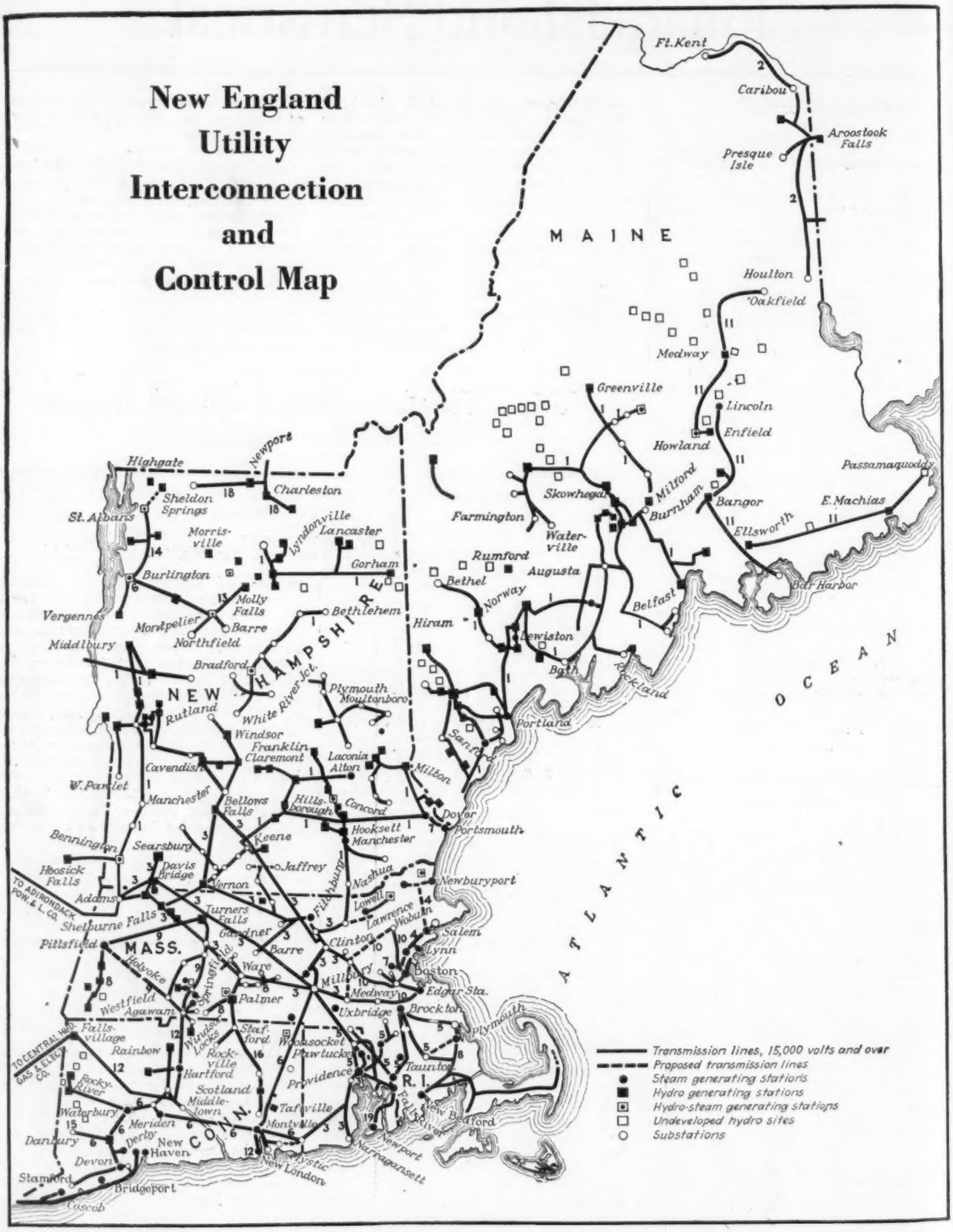
During this period of reductions of rates and extensions of lines the increased use of electricity and gas for industrial purposes has maintained the volume of earnings of the electric power and gas companies in their wholesale departments with remarkable stability, and with many companies the earnings of these departments have increased. In the past few years the growth of the sale of electricity and gas to households has had a more rapid increase than ever before, owing to the multitude of useful labor-saving household appliances that are being purchased to save time and drudgery.

One important factor that investors are just beginning to realize is that during the past twenty years, when the utility companies have been extending their lines and mains, these companies have covered their territories very thoroughly, and now as new residences, stores and factories are built in these cities and towns, it takes a smaller expenditure of money for property to secure this business than ever before, thus creating the very desirable situation of an increased earning power per dollar of investment each year.

OUTSIDE INTERESTS BUY PROPERTIES

Interests outside of Massachusetts have during the past year awakened to all of the benefits which the shareholders of Massachusetts companies are to realize during the next few years from this accumulation of assets and from the conservative management and earning power that is to come from these completed distribution systems, and they have been vigorously buying what they could acquire in the market through the purchase of shares.

This outside ownership has been increased to a degree where shareholders of possibly a majority of the companies in Massachusetts have come to think that it may endanger the continuity



1. Insull interests (*F*)
2. Pierce interests (*F*)
3. New England Power Association
4. Charles H. Tenney & Company (*L*)
5. Stone & Webster, Inc. (*L*)
6. United Gas Improvement Company (*F*)
7. Associated Gas & Electric Co. (*F*)
8. Massachusetts Utilities Investment Trust (*L*)
   C. D. Parker & Company
   Massachusetts Lighting Company
9. Western Massachusetts Companies (*L*)
   Turners Falls Power & Electric Company
   Pittsfield Electric Company and affiliated companies
10. Edison Electric Illuminating Company of Boston (*L*)
11. Bangor Hydro-Electric Corporation (*L*)
12. Connecticut Power Company
    Hartford Electric Light Company (*L*)
13. George L. Ohrstrom, New York (*F*)
14. Public Electric Light Company (*L*)
15. Cities Service Company (*F*)
16. Rockville & Willimantic Lighting Company (*L*)
17. Derby Gas & Electric Corporation of New York City (*F*)
18. W. B. Foshay & Company (*F*)
19. Colonial Gas & Electric Company, New York (*F*)

(*F*) Represents control outside New England. (*L*) Represents control within New England.

of the managements of these companies by Massachusetts men with whose records they are thoroughly familiar. The shareholders in Massachusetts wish to realize annually the benefits which it is very apparent that shareholders of Massachusetts electric power and gas companies are to receive during the next few years—benefits which are now being eagerly sought by outside interests for their own accounts. Their simplest and best method of retaining control for themselves and for the other shareholders of their companies who have held their shares during the long period of development and during the uncertainties of the war is to form voting-trust agreements. These voting-trust agreements usually specify that some bank shall be the custodian of the shares of the company deposited and that Massachusetts men, well known to the shareholders, shall have the privilege of voting the shares, so that none of the shares held under the voting-trust agreement shall be sold for a certain period of time or at a figure below that which, in the minds of these custodians, will properly represent the value of the shares over a period of years.

The only criticism made concerning voting trusts is that they place in the hands of a few individuals the votes of many shareholders; but the answer to this criticism is that shareholders elect to take this course and that they would prefer to have the voting control of their companies in the hands of men they know and who have been identified with the conservative building up of these companies rather than to have it pass to the control of a few men representing outside interests with whom they are not familiar and whose policies are not known to them.

American Water Works to Reincorporate

At a meeting of the board of directors of the American Water Works & Electric Company held June 14 a plan to reincorporate the company in Delaware was approved. The plan includes the call for redemption on Aug. 15 of the outstanding 7 per cent preferred stock and the issuance of a six-dollar series no-par-value preferred stock. Holders of the 7 per cent preferred stock will be given the opportunity to exchange for the new six-dollar series preferred stock. The outstanding common stock will be exchanged for new no-par-value common stock on the basis of two shares of new stock for each share of old. It is proposed that the reincorporated company shall declare an initial dividend on its common stock payable Aug. 15 in cash and common stock which shall be the equivalent of the dividend on the present common stock. The company will profit by a substantial saving in annual franchise taxes, and the stock of the reincorporated company will be free of Delaware inheritance tax to non-residents of Delaware.

New Offerings Total $39,500,000

During the week ended June 23 electric light and power securities offered the investing public totaled $39,500,000. Another substantial offering was made by the Iowa Public Service Company in the form of first mortgage gold bonds, amounting to $12,000,000. These bonds, dated June 1, 1927, and maturing June 1, 1957, were priced at 97½ and interest.

The largest individual offering was made by the Utilities Power & Light Corporation in the form of 5½ per cent 20-year gold debentures offered at 94½ and accrued interest, the issue involving a total of $20,000,000.

The Illinois Power & Light Corpora-

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday June 21	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	93½	83	97½
Adirondack Pwr. & Lt.—7% pf.	110½	107	111½
Adirondack Pwr. & Lt.—8% pf.	113	112	115
Ala. Pwr., $7 cum. pf.—no par	111	107	112½
Allis-Chalmers Mfg., 7% pf.	k111½	109	112½
Allis-Chalmers Mfg., 6% com.	106½	88	111½
Aluminum Co. of Amer., com.	79½	67½	81½
Aluminum Co. of Amer., 6% pf.	k104	101½	104½
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	100½	86½	101½
Amer. & Foreign Pwr., com.—no par.	22½	18½	25½
Amer. Bosch Magneto, com.—no par	15½	13	18½
Amer. Brown Boveri Elec†	14½	12	39½
Amer. Brown Boveri Elec., pf. $7	64	50½	98
Amer. Gas & Elec., 6% pf.—no par	101½	95½	101½
Amer. Gas & Elec., com.†—no par	89	68½	100½
Amer. Lt. & Trac., 6% pf.	115	112	120
Amer. Lt. & Trac., com.†	m258½	222	265
Amer. Pwr. & Lt., 6% pf.	104	97½	105
Amer. Pwr. & Lt., com.†—no par	62½	54	67
Amer. Pub. Serv., 7% pf.	k100	95	99½
Amer. Pub. Serv., com.†	65	....	....
Amer. Pub. Utilities, 7% ptc. pf.	k 87	73	88
Amer. Pub. Utilities, 7% pr. pf.	95	88	93
Amer. Pub. Utilities, com.	57	65	70
Amer. States Sec., A	3	2½	4½
Amer. States Sec., B	3	2½	4½
Amer. Superpwr., 6% ptc. pf.—25	29	26½	29½
Amer. Superpwr., 6% 1st pf.	f 96½	....	....
Amer. Superpwr., Class A†—no par	37	27½	38½
Amer. Superpwr., Class B†—no par	37½	28½	39½
Amer. Wtr. Wks. & Elec., 7% pf.	111	105	111
Amer. W. W. & E., com. $1.60—20	91½	62½	98
Anaconda Copper cap. $3	44½	44½	49½
AppalachianElectric Pwr., 7% pf.	103	98	104
AppalachianElec. Pwr., 7% 2nd pf.	104½	100	102
Appalachian Elec. Pwr., com.	m78	....	....
Arizona Pwr., 7% pf.	81	77	84½
Arizona Pwr., com.	22	....	....
Arkansas Pwr. & Lt. 7% pf.	102½	....	....
Assoc. Gas & Elec., $3.50—50	51½	....	....
Assoc. Gas & Elec., pf.—$6—no par	92	85	93
Assoc. G. & E., Class A, 10—no par	40½	35	43
BABCOCK & WILCOX, 7% com.	117	115	123
Binghamton L., H. & P., $6 pf.	97	93	98
Birmingham Elec., pf.—$7—no par	107½	105	109
Blackstone Valley G. & E., 6% pf.	106	103	105
Blackstone Valley Gas & Elec., 10% com.—50	127	98	154½
Blaw-Knox, com.†	f 70	70	73
Brazilian Trac., Lt. & pwr., com.†	f160½	....	....
Broad River Pwr., 7% pf.	101	97	100
Brooklyn Edison, 8% com.	166½	148½	176
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	f 25½	....	....
Buffalo, Niagara & East. Pwr. com. $1—no par	f 31½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	97½	96	99½
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	f108½	107	109½
Central & S.W. Util., $7 pf.—no par	a 97	93½	97½
Central & S.W. Util., pr.in.$7 pf.—no par	a101	98½	103
Central Ariz. Lt. & Pwr., 8% pf.	k 97	95	98
Central Ark. Ry. & Lt., 7% pf.	102	100	104
Central Ill. Pub. Serv., $6 pf.	a 91½	88½	95½
Central Ind. Pwr., 7% pf.	91	86	95
Central Pwr. & Lt., 7% pf.	102	100½	103
Central States Elec., 7% pf.	95	93	96
Central States Elec., com.†	m200	....	....
Century Elec., 6% com.	m115	115	115
Chicago Fuse Mfg., com.—$2.50 no par	m 35	30	35
Cincinnati Gas & Elec., 5% com.	g 98½	96½	99
Cities Service, 6% pf.	f 88	88½	92½
Cities Service, pf. B—10	f 8	8	8½
Cities Service, pf. BB—100	f 82	80½	85
Cities Service, com.—20	f 46	40½	58½
Cities Service, Bks. Shrs.—10	f 23½	22½	29½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	110½	108	110
Cleveland Elec. Illg., 10% com.	298	285	310
Columbia Gas & Elec., 6% pf.	105½	99½	107½
Columbia G. & E. com. $5—no par	94½	82½	98½
Columbia Ry., Gas & Elec., 6% pf.	m 94	....	....
Columbus Elec. & Pwr., $2 com.—no par	65	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	102	98½	102½
Columbus Ry., Pwr. & Lt., 6½% pf. B	102	96	103½
Columbus Ry., P. & L., com.—no par	70	75	79
Commonwealth Edison, 8% com.	a151½	138	155
Commonwealth Pwr., 6% pf.	k 98	91½	98
Commonw'th Pwr., $2, com.—no par	54½	48½	54½
Conn. Lt. & Pwr., 8% pf.	k120	119	123
Conn. Lt. & Pwr., 7% pf.	k113	112	113½
Cons. Gas of N. Y., pf.†—50	m 56½	55½	62½
Cons. Gas of N. Y., com $5—no par.	102½	94	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	k105	105	107
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e112	110½	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e113½	112½	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	k126	126	128
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par.	e 58½	51	59½
Consolidated Pwr. & Lt., 7% pf.	k105	100	106
Consumers Pwr., 6% pf.	101½	100	102
Consumers Pwr., 6.6% pf.	105	103	105½
Continental Gas & Elec., 8% ptc. pf.	106	103	106½
Continental Gas & Elec., 7% pr. pf.	101	100	103
Conti. G. & E. com. $4.40—no par.	k210	210	225
Crocker Wheeler, com.†	31	30	38
Crocker Wheeler, 7% pf.	84	78	88
DALLAS PWR. & LT., 7% pf.	109	107	109½
Dayton Pwr. & Lt., 6% pf.	k105½	101	103
Detroit Edison, 8% com.	147½	133½	157
Dubilier Condenser, com.—no par.	4½	3½	5½
Duquesne Lt., 7% pf.	116½	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	105	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	8	9	13
Eastern States Pwr., pf.	88	90	95
East. Tex. Elec., 7% pf.	107	106	108
Edison Elec. of Boston, $12 com.	d244	217	267
El Paso Elec., 7% pf.	109	105	107½
Elec. Bond & Share, 6% pf.	f107½	105½	109½
Elec. Bd. & Sh. Sec., com. $1—no par	f 72½	67½	76½
Electric Household Util.†	a 13½	11	15½
Elec. Investors, 6% pf.—no par.	94	92	96
Elec. Investors, com.†—no par.	37½	32½	40½
Elec. Investors, 10% pd. receipts.	m 15	....	....
Elec. Pwr. & Lt., ctfs. pf.	104	96	106½
Elec. Pwr. & Lt., ctfs., 40% pd.	k112	103½	115
Elec. Pwr. & Lt., ctfs, full pd.	m114	108½	111½
Elec. Pwr. & Lt., ctfs., com.—no par.	21½	16½	23½
Elec. Refrig. cap.†	21½	19½	37½
Elec. Ry. Securities, com.—no par.	m 7½	6	8
Elec. St. Battery com. $5.25—no par	67½	63½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	102	99	101½
Emerson Elec., pf.	m111	108½	111
Empire Pwr., ptc.†.	33½	26	37½
Engr. Pub. Serv., $7 pf.—no par.	104	93½	106½
Engr. Pub. Serv., com.—no par	26½	21½	28½
Eureka Vacuum Cleaner, com. $4—no par.	73½	60½	74½
FAIRBANKS MORSE, 7% pf.	k110	107½	112
F.-M., com.—$3—no par.	38	37½	43½
Federal Lt. & Trac., com. $1.40	43½	37½	47
Federal Lt. & Trac., $6 pf.—no par.	98½	91½	99½
Ft. Worth Pwr. & Lt., 7% pf.	f111	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	67	68	72
Galveston-Houston Elec., com.	30	28	32
Gen. Elec., $3 com.—no par.	105	81	108½
Gen. Elec., special—6%	11½	11½	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	41	34	47½
Gen. G.&E. (Del.) com. B—no par.	42	35½	43½
Gen. G.&E. (Del.) pf. A. $8—no par.	k117	113½	120
Gen. G.&E. (Del.) pf. A $7—no par.	k107½	100	109½
Gen. G. & E. (Del.) pf. B $7	k102	96	104½
Gen. Pub. Serv., $7 conv. pf., no par	k107½	102	106
Gen. Pub. Serv. com., no par	14½	11½	15½
Ga. Lt., Pwr. & Rys., 6% pf.	94	87	92
Ga. Lt., Pwr., & Rys., com.	m 60	....	....
Ga. Ry. & Pwr., 8% pf.	k123	119	123
Ga. Ry. & Pwr., 7% pf.	k113½	106	110
Gt. Western Pwr., 7% pf.	h102½	....	....
IDAHO PWR., 7% pf.	107	103	105
Ill. No. Utilities, 6% pf.	k 88	88	92
Ill. Pwr. & Lt., 7% pf.	100	99	101
Ingersoll Rand com. $8	k 89	89½	96½
Int. Combus. Engr., com. $2—no par	45½	43½	64
Int. Util., Class A—$3.50—no par.	40½	28	41½
Int. Utilities, Class B—no par.	6½	3	7½
Interstate Pwr., pf.—$7—no par.	95½	93	98
Interstate Pub. Serv., 7% pf.	100	98	99½
Iowa Ry. & Lt., 7% pf.	98	97	99
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	100½	97½	103
Johns-Manville, com.†—no par.	80½	55½	86

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, June 18. lBid price Wednesday, June 22. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday June 21	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	k115	112	115½
Kansas Gas & Elec., 7% pf.	l105½	103	107
Kentucky Hydro-Elec., 7% pf.	k 96	....	....
Kentucky Sec.,6% pf.	k 86	83	87
Kentucky Sec., 5% com.	109½	110	115
Kentucky Utilities, 6% pf.	98	95	98½
Keystone Pwr. & Lt., 7% pf.	98	96	98½
LACLEDE GAS LT., 12% com.	k245	173½	267½
Lehigh Pwr. Sec., com.—no par	18½	15	20
Long Island Ltg., 7% pf.	109	107	112
Long Island Ltg., com.†—no par	144	139	153
Los Angeles Gas & Elec., 6% pf.	100½	98	100½
Louisville Gas & Elec., cl. A $1.75	26½	23½	27½
MAN. ELEC. SUPPLY, cap. $5—no par	75	53½	77½
Manila Elec., com.†—no par	k 43½	40	46
Maytag Mfg., com. .50—no par	31½	23½	32½
Memphis P. & L., pf.—$7—no par	107	107	109
Metropolitan Ed., pf.—$6—no par	9½	93	100
Metropolitan Ed., pf.—$7—no par	106	104	108
Metropolitan Ed., com. $5—no par	67	....	....
Middle West Utilities, 7% pf.	a110	105½	113½
Middle West Util., 8% pr. lien	a120	117½	122½
Middle West Util., com. $6—no par	a111½	108	117½
Midland Utilities, pr. ln. 7% pf.	a105½	98	105½
Midland Utilities, 7% pf. A	a102½	92½	102
Milwaukee Elec. Ry. & Lt., 7% pf.	k102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98	98	101½
Minn. Pwr. & Lt., 7% pf.	l105	104	107
Miss. Pwr. & Lt., $8 pf.	k114	106	111
Miss. River Pwr., 6% pf.	98½	94	97
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	k106½	98	109
Mohawk Hudson Pwr., 2d pf.—$7—no par	k108	98	109
Mohawk Hudson Pwr., com.—no par	k 25	20½	27
Montana Pwr., 7% pf.	m121½	118½	123
Montana Pwr., 5% com.	m 99½	81½	104½
Montreal Pwr., 7½% com.	f 84½	....	....
Mountain States Pwr., 7% pf.	100½	97	101
Mountain States pwr., com.†	19	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	105
National Carbon, 8% pf.	m137	130½	137½
National Elec. Pwr., A†	a 24½	23½	25½
National Lt., Ht. & Pwr., com.	a 24½	....	....
National, Light, Ht. & Pwr., 5% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	k107	101	108½
National Pwr. & Lt., com.†—no par.	21½	19½	23½
National Pub. Serv., 7% pf.	k 98½	93	100
National Pub. Serv., 7% ptc., pf.	113	108	115
National Pub. Serv., A com. $1.60—no par	23½	18½	24
National Pub. Serv., B com.—no par	19½	14	20½
Nebraska Pwr., 7% pf.	l109½	106	108½
Nevada-Calif. Elec., com.	m 28½	25	31
New Brunswick Pwr., 4% pf.	55	....	....
New Eng. Pub. Serv., pr. ln. pf. $7.	100	98½	101
New Eng. Pub. Serv., pf. $7	97	95	97½
New Orleans Pub. Serv.—7% pf.	104½	103	105½
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	k 92	91	95
N. Y. Central Elec., 7% pf.	k103	102	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25.	29	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	111½	110½	113
No. Amer., 6% pf.—50.	51	50	52½
No. Amer., com.—10	49½	45½	52½
No. Amer. Edison, $6 pf.—no par.	101½	96½	101½
No. Caro. Pub. Serv., pf.—$7—no par	100	93	100
Northeastern Pwr., com.	16½	14½	18½
No. Indiana Public Service, 7% pf. A.	104½	102	104
No. N. Y. Utilities, 7% pf.	105½	103	109
No. Ohio Pwr., com.—no par.	11½	9½	13½
No. Ohio Trac. & Lt., 6% pf.	80	78	81
No. Ohio Trac. & Lt., 7% pf.	90	90	93
No. Ont. Lt. & Pwr., 6% pf.	k 92	84	94½
No. Ont. Lt. & Pwr., 4% com.	74	73	78
No. States Pwr., (Del.) 7% pf.	105½	100½	107
No. States Pwr., (Del.) 8% com.	120	109½	124
No. Texas Elec., 6% pf.	70	65	70
No. Texas Elec., com.	22	27	36
OHIO BRASS, com. B $4—no par.	83	74	85
Ohio Brass, 6% pf.	105	100	105
Ohio Pwr., 6% pf.	102½	96	103
Ohio Pub. Serv., $6 pf.	97	95	96½
Ohio Pub. Serv., 7% pf.	108	103	109
Ohio River Edison, 7% pf.	107	103	109½
Oklahoma Gas & Elec., 7% pf.	100½	....	....
PACIFIC GAS & ELEC., 6% pf.	26	24½	26½
Pacific Gas & Elec., 8% new com.	37½	31	39½
Pacific Pwr. & Lt., 7% pf.	l104	102	104
Penn Cent. Lt. & Pwr., $5 pf.—no par ex. div.	c 74½	71½	75
Penn-Ohio Edison, 7% pf.	100½	97½	104
Penn-Ohio Elec., 7% pf.	99	98	100
Penn-Ohio Pwr. & Lt., 7% pf.	103	99	103
Penn-Ohio Pwr. & Lt., 8% pf.	113	109	113
Penn Pwr.& Lt.—$7—no par.	l108	107	108½
Penn Wtr. & Pwr., 8% com., new	c 47½	48½	49
Phila. Co., 6% pf.—50.	k 51½	50	53
Phila. Co., com.—50.	k100	85½	110
Phila. Elec., 8% com.—25.	c 51½	46½	54
Portland Elec. Pwr., 7% pf.	99	97½	101
Portland Elec. Pwr., 6% pf.	k 77	78	83
Portland Elec. Pwr., 7% 2d pf.	55	55	70
Portland Elec. Pwr., com.	26	22	30
Potomac Elec. Pwr., pf.	m108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m 79	....	....
Pwr. Sec., pf.—no par.	k 28	28	33
Pwr. Sec., com.—no par.	k 6	5	8
Public Serv. of Colorado, 7% pf.	l100	90	100
Pub. Serv. of N. J., 6% pf.	k100½	98½	101½
Pub. Serv. of N. J., 8% pf.	k130	125	131½
P. S. of N. J., $2 com.—no par.	40½	32	45½
Pub. Serv. of No. Ill., 6% pf.	a103½	101½	105½
Pub. Serv. of No. Ill., 7% pf.	a115½	112½	116½
P. S. of No. Ill., com. $8—no par.	a141	130½	143
Pub. Serv. of No. Ill., $8 com.	a141	132	142
Pub. Serv. of Okla., 7% pr. ln.	100	99	100½
Pub. Serv. Elec. & Gas, 6% pf.	106½	102	108½
Puget Sound Pwr. & Lt., 7% pr. pf.	109	105	107
Puget Sound Pwr. & Lt., $6 pf.—no par	87	....	....
Puget Sound Pwr. & Lt., com.	33½	28	35½
RADIO CORP. OF AMER., $3.50 pf.—50.	51½	49	53
Radio Corp. of Amer., com.—no par.	52½	41½	56½
Republic Ry. & Lt., pf.	k120	....	....
Republic Ry. & Lt., com.	k135	112	135
Rochester Gas & Elec. 6% pf. D.	k104½	101	103½
Rochester Gas & Elec., 7% pf. B.	106	105	107
Rochester Gas & Elec., 6% pf. C.	104	101½	103½
SAFETY CABLE, com. $4.	71½	52½	72
San Joaquin Lt. & Pwr., 7% pr. pf.	106	105	108
St. Joseph Ry., L., H. & P., 5% pf.	72	70	73
Servel Corp.	4½	3½	10½
Sierra Pacific Elec., 2% com.	m 24	....	....
Sioux City Gas & Elec., 7% pf.	103	99	104
Southeastern Pwr. & Lt., pf.—$7 no par	l104	....	....
Southeastern Pwr.& Lt.,ptc.pf.	l 79½	....	....
Southeastern Pwr. & Lt., com.—no par	35½	29½	38½
So. Calif. Edison, 8% pf.	36	36½	38
So. Calif. Edison, 7% pf.	28½	27½	28½
So. Calif. Edison, 6% pf.	25½	24½	25½
So. Calif. Edison, 5% com.	35	31½	36½
Southern Cities Utilities, 7% pf.	80	81	86½
Southern Cities Utilities, com. $4.	m 37	....	....
Southwestern Lt. & Pwr., A $3.	k 65	60	65
Southwestern Lt. & Pwr., B.	k 65	60	65
Southwestern Lt. & Pwr., $6 pf.	k 84	83	91½
Southwestern Pwr. & Lt., 7% pf.	k109½	103	110½
Springfield (Mo.) Ry. & Lt., 7% pf.	102	95	102
Standard Gas & Elec., 8% pf.	63	67½	64
Standard Gas & Elec., 7% pr. pf.	109	103	110
Standard G. & E., com. $3.50—no par	60½	54	65½
Standard Pwr. & Lt., 7% pf.	102	98	102½
Staten Island Edison, pf.—$6—no par	k100½	99	101
Superheater, $6 com.—no par.	175	170	185
Syracuse Lighting, 7% pf.	105½	103	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.—no par	300	....	....
TAMPA ELEC., com. $2.	59	49	64
Tenn. Elec. Pwr., 6% pf.	95½	92	97
Tenn. Elec. Pwr. 7% pf.	105½	103	106½
Terre Haute, Ind. & East. Trac., 5% pf.	20	20	25
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	l109½	106	109½
Tide Water Pwr., 8% pf.	108	105	108½
Timken Roller Bear., com.—$4 no par	102½	78	106½
Toledo Edison, 8% pf.	115	115	118
Toledo Edison, 7% pf.	l106½	104	106½
Toledo Edison, 6% pf.	k 98	95	97
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	97	90	97
UNITED GAS & ELEC., 6% pf.	k100	98	102
United Gas & Elec., com.—no par.	m 57	....	....
United Gas & Elec. (N. J.) 5% pf.	72	70	73
United Gas Impr., 8% com.—50.	c106	89½	108½
United Lt. & Pwr., pf.—$4—no par.	51	49	53½
United Lt. & Pwr., pf.—$6.50—no par	95½	87	97½
United L. & P., com. A .48—no par.	13½	12½	15½
United L. & P., com. B .48—no par.	a 17	15	18
Utah Pwr. & Lt., 7% pf.	i 106½	104	108½
Utica Gas & Elec., 7% pf.	106½	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	95	93	100
Utilities Pwr. & Lt., com. A $2.	31½	27	34
Utilities Pwr. & Lt., com. B $1—no par	17½	13½	19
VERMONT HYDRO-ELEC., 7% pf.	97½	95	97½
Virginia Elec. & Pwr., 7% pf.	107	105	107
Virginian Pwr., 7% pf.	108	....	....
Virginian Pwr., com.	70	....	....
WAGNER ELEC., 7% pf.	b 87½	68	90
Wagner Elec., com.—no par.	b 36	18½	39½
Washington Ry. & Elec., 5% com.	257	....	....
Washington Ry.& Elec.,5% pf.	m 91½	....	....
Washington Wtr. Pwr., 8% com.	155	136	160
West Penn Elec., 7% pf.	110½	102	110½
West Penn Elec., Cl. A $7.	k105½	97½	110
West Penn Pwr., 7% pf.	113	111	118
West Penn Pwr., 6% pf.	107	100½	108
West Virginia Lt., Ht. & Pwr., 7% pf.	90	94	96
West Va. Utilities, 7% pf.—50.	51	48	51½
Western Pwr., 7% pf.	k 99	98	101½
Western States Gas & Elec., 7% pf.	k100	96	100½
Western States Gas & Elec., com.	24	....	....
Westinghouse Elec. & Mfg., 8% com.—50.	74½	67½	77½
Weston Elec. Instrument, Cl. A $2—no par.	32	30½	34½
Weston Elec. Instrument, com.—no par.	14½	14½	18½
Wheeling Elec., 6% pf.	100	95	97
Worthington Pump, 7% pf. A.	k 59	46	61½
Worthington Pump, 6% B.	k 52	40	54½
Worthington Pump, com.	41½	20½	46
YALE & TOWNE com. $5—25.	k 80½	70½	81

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, June 18. *l*Bid price Wednesday, June 22. *m*Latest quotations available. †Dividend rate variable.

tion issued first and refunding mortgage gold bonds, series C, at 97 and interest, yielding 5.2 per cent, a piece of financing involving $4,000,000.

The Houston Lighting & Power Company issued first lien and refunding mortgage gold bonds, series A, to the amount of $2,000,000, the price being 99¾ and interest.

First and refunding mortgage gold bonds, 5 per cent series, due 1955, of the Minnesota Power & Light Company were offered during the week under review to the amount of $1,500,000, the price being 99¼ and interest, yielding over 5 per cent.

Maine Adds Bonds to Legal Investments List

The Bank Commissioner of the State of Maine has prepared a new list of securities which he considers legal investments for savings banks as of May 2, 1927. The new additions to the list include the following securities of electric light and power companies:

Central Hudson Gas & Electric Corporation:
- First and refunding 5s, 1941.
- Kingston Gas & Electric Company, first 5s, 1952.

Lake Superior District Power Company:
- First and refunding B 5s, 1956.
- Ashland Light, Power & Street Railway, first 5s, 1939.
- Ironton & Bessemer Railway & Light Company, first 5s, 1936.

New England Power Company, first 5s, 1951.

Northern Indiana Public Service Company:
- First and refunding B 5½s, 1960.
- First and refunding C 5s, 1966.
- Indiana Lighting Company, first 4s, 1958.
- Northern Indiana Gas & Electric Company:
  - First and refunding 5s, 1929.
  - First lien and refunding 6s, 1952.

Public Service Company of New Hampshire:
- First and refunding A 5s, 1956.
- Manchester Traction, Light & Power Company:
  - First and refunding 5s, 1952.
  - First and refunding 7s, 1952.

Wisconsin Valley Electric Company:
- First A 5s, 1942.
- First B 5½s, 1942.
- First C 5s, 1942.

Kansas Power Bonds Made Legal in Rhode Island.—The Rhode Island Banking Commission has approved as legal investment for savings banks the Kansas Power Company 5 per cent first mortgage bonds, due 1947.

Kentucky Utility Increases Stock.—The Kentucky Power Company has filed a certificate at Dover, Del., increasing its authorized preferred stock from $900,000 to $1,900,000 and its common stock from 11,000 to 31,000 shares of no par value.

Massachusetts Utility Increases Dividend.—The directors of the United Electric Light Company, Springfield, Mass., have declared a quarterly dividend of $1 per share on the outstanding $4,000,000 capital stock, par $25, payable June 30 to holders of record June 15. This compares with a dividend of 75 cents per share paid three months ago.

Manufacturing and Markets

Use of Purchasing Information

Knowledge of Basic Price Trends Needed — Responsibility of Purchasing Department in Present Phase of Economic Cycle—Cost Analysis of Goods

By Edward T. Gushée
Purchasing Agent Detroit Edison Company

THE first purchase, like the first sale, was made by barter. In the years of progress all other parts of business—finance, engineering, production, sales and accounting—have been developed, yet in the purchase of supplies the process, until recent years, has not differed much from barter. "Dicker" has been substituted for "barter" perhaps; but purchase has been carried on mainly by rule-of-thumb methods and shrewd trading. Through periods of emphasis on development, production and sales, industry, after the World War, came to a realization of the importance of careful study of the underlying economics of the situation.

Scientific Purchasing

It is now generally realized that to recoup a dollar lost in purchase the sales department must sell from $10 to $15 gross. Professor Lincoln in his book on "Applied Business Finance" estimates that from 40 per cent to 60 per cent of the total financial outlay of industry, including taxes, interest on bonded indebtedness, payrolls and dividends, is spent for material—either for production or capital investment. These two facts conclusively show the importance of purchase as a primary part of industry. What we may term "scientific purchasing" is beginning to grow from this realization of the dollar value of purchasing.

Quite candidly it may be said, as a generalization, that in the past buying was a sub-function of some department or departments in a company other than the purchasing department, and that the buyer was to a large extent a glorified stenographer. Why, then, is it necessary that the buying, not selection, be centralized in the purchasing department? One, among other reasons, is that the modern purchasing department is trained in its special function, that it is commercially minded and therefore better equipped to transact the commercial part of a purchase.

What Makes a Good Buyer?

The buyer must know materials even better than the salesman who specializes therein. He must be a specialist. Buyers who efficiently purchase equipment and materials of a technical nature are engineers who have been especially trained in their lines, mechanical, electrical, chemical, etc., and likewise in other branches of purchase is the specialist finding his place. A buyer must be fair. By this is meant not simply strictly ethical, in accordance with so-called business ethics, but that he must have a long-range vision so that he may realize the possible effect of the negotiations—not only on the immediate deal in hand, but also on the economic situation and the future development of the equipment or material. Third, he must be a good salesman. Salesmen have often found the buyer to be the salesman's best aid. In other words, the buyer must be able to sell his proposition to his own company.

THE compilation and the use of purchasing information can be applied equally by the manufacturer in his purchase of raw material and the central-station company in buying to meet its various requirements. A knowledge of the proper methods of purchasing is also valuable to the salesman to enable him to direct his energies along more effective lines. Mr. Gushée's article which is presented here analyzes the application of sound principles to modern buying methods.

It is an error if a purchasing department—speaking in a general way—abrogates to itself even the hint of the prerogative of selection. This is the function of the engineering or production or design departments of the company. However, while the modern purchasing department does not necessarily select materials, it does have the right to question and suggest. This right—or, better, duty—with the proper cooperation between departments of a given company, will accomplish all that may be desired in the actual selection of materials.

It will be seen that a buyer to be properly equipped for his work has a tremendous task ahead of him, a task which is unending in that he must constantly keep himself abreast of developments and must constantly study to better his knowledge of the materials in which he is interested. This is an argument for increased personnel to handle the job properly and adequate compensation to the buyer in order that capable men may be secured and retained.

The function of purchasing is to obtain the correct quality to fit the given requirements, with the best delivery—that is, service—at the best price. How does a purchasing department operate in order to carry on this function? There is no body of experience from which to draw; therefore it will be found that most well-organized buying divisions use a cut-and-try method which is working successfully and from which axioms of purchase methods are being slowly developed. Among other things to be considered in these purchasing methods are the following factors: (1) Compilation of information; (2) the right time at which to buy; (3) the right price at which to buy, and (4) the right quantity and quality to buy.

Two of these factors will be discussed, compilation of information and buying at the right price.

Compilation of Information

Compilation of information is one of the first duties of a well-organized purchasing department. By this is meant the collection of that data which may be termed the "ammunition" of the department. It is impossible for the buyer, with the number of actual purchases which he must make, to keep actively abreast of economic conditions or to make adequate study of complicated deals without some outside assistance. This is especially true in larger companies where the volume of purchasing is considerable. On the other hand, the same principle may be applied in the small companies. In these companies there are generally one or two items which are most important in the list of commodities used. The purchasing agent himself in these instances, by the application of the general principle, can make the necessary studies.

Records Are Carefully Kept

As has been indicated, the modern buyer has found it absolutely necessary to organize the study of general economic conditions and to keep adequate record of price trends, actual prices and information of all kinds which may help him to buy. This division of the purchasing department is to all intents and purposes the "division of economics." The duties of this division include posting of all orders. All orders are posted to cards in a visible index. These cards, filed by class of material, show the quantity, date of purchase, vendor, price, discount and special terms, if any. This is the basis for complete studies of a given type of material, for standardization, quick reference to past prices, quantities involved and so forth. While somewhat costly to organize, the maintenance cost is negligible and the purchase dividends accruing from its use are most worth while. Information of this kind is essential in any thorough study of purchases—the more varied the purchases the more necessity for the information. There are many ways of compiling this

data and the filing or classification requires careful study and will differ in each type of company. A year's work by trial-and-error methods may be required before hitting upon a practicable classification.

CHARTS SHOW VARIOUS TRENDS

It is necessary to prepare charts for visual analysis of the price and production trends of many of the raw materials entering into purchases. These charts go back from ten to twenty years, showing prices of such materials as copper, lead, various sorts of steel, pig iron, rubber, oils and gasoline, hard and soft woods, cotton and other commodities. Careful studies of these charts should constantly be made to discover indices such as the general price movement, stocks on hand, car movements and stock market prices which will foretell a movement in price of the particular commodity under consideration. For instance, it is seen that the Thursday price of gasoline varies quite uniformly, over a period, from the Monday price. This could be helpful in deciding a weekly average contract. These studies are only indicative of conditions and must be considered along with other factors of as great or greater influence. It will be found that many studies produce no practical results, and then again an analysis will be hit upon by these means which in some cases will more than pay the entire cost of this work.

The personnel of the economics division of a purchasing department may also be available, in co-operation with the buyer, for detailed studies of various classes of purchase, or any part thereof, which need special attention. These studies may lead into the operating departments, construction or design, with a study of sources and quantities and an inevitable emphasis on standardization. This means not only the necessity for a commercial sense, but the ability to understand the engineering features involved and the requisite tact to secure careful and prompt consideration. These studies should be completed by a thorough report covering recommendations as to quality (approved by the engineering corps), a specification if none has been hitherto available, sources, quantity and time to buy, average cost on a given market and an estimate of the probable price trend. It can be easily seen that some of these studies are most interesting as well as being most complicated. Experience shows that the dollar result to the company is most gratifying and that the quality invariably is improved with resultant indirect savings.

DAILY PRICE RECORD

Every day the economics division should send to the buyers a list of the market prices of the basic materials for reference in their negotiations and also to be "spotted" on the quotation sheets of that day. These sheets should be filed with the order as a permanent record in the economics division, making a record easily referred to not only of the price at which the order was placed but for later analysis of the markets at which that price was figured. The usual markets for this purpose include pig iron, cotton, copper, lead and steel. A wage index should also be kept. This division also can carry on a bit of work which, while helpful, may be at times embarrassing; that is, to chart the actual markets and then, plus and minus, chart the actual purchases against those markets, weighted for quantity and any other unusual conditions, and show thereby whether the purchasing department has been buying correctly. This at best is only a guide to the actual result, because of the difficulty in charting the "unusual conditions."

All publications, trade magazines, bulletins and economic services can be centralized in that division. Proper distribution throughout the department on a schedule can be made and interesting items marked or clipped. From these publications, as authorized by the purchasing agent, prices can be posted to the charts. It will be found that by careful distribution and analysis of the requirements of the individual no one will be over-burdened with reading matter and yet each one will receive that information in which he is particularly interested.

MAINTENANCE OF CATALOG FILE

A complete catalog file should be maintained and kept up to date. This is no small task and requires very careful organization. This can be the company as well as the department file and be referred to by all other departments interested. The information collected by this division will be in demand by many other departments of the company—the statistical, estimating, construction and others—and will even be referred to in a general way in questions of budget and financing. Special reports on purchases and material studies, or reports on facilities of a given vendor, should be filed by this division. Making a formal report on the plant, personnel and financial set-up of new sources can be made very valuable to an organization.

Every purchaser is most interested in buying at the right price, for everything else is merely preparatory to the achievement of this end. While it may rightfully be said that quality and service are of paramount importance, yet it is the aim to obtain these two at the lowest price consistent with the buyer's interest, but not necessarily at the lowest price obtainable. This is a phase of the subject which at this period in the economic cycle must have most serious consideration from every clear-thinking business man. In the economic cycle in which we now are, and which will probably continue for some years, the purchasing profession has a tremendous responsibility. Last year saw an increasing volume of distribution and declining commodity prices—the first time in history that such a combination existed. This tendency in general will continue for some time. We have been for three years, we are now and shall continue for some years to be in what we term a "buyers' market." It is more essential than ever, for the purchaser's own self-interest and for the general economic good of the entire country, that buying be carried on ethically and with a long-range vision.

There has grown to be a distinct tendency in some industries, because of competitive conditions, and short-sightedness, to force prices below the cost of production where the lever of volume of purchase was sufficient. This is suicidal, for we help to destroy our own markets and to throw out of balance the general economic situation. It is a complicated subject. It may be argued that competition forces such action, and it may be argued further that this action often forces improvements in methods with a consequent decline in costs. All this is true, but it goes beyond these facts. The condition exists and in some manner must be worked out. A fair price under competitive conditions—a price which permits development—is essential, not under the golden rule necessarily, but from the purchaser's enlightened self-interest. It is possible to force prices too low. It all fits in with the progress in the art of buying. It gives force to the statement that it is indispensable that the buyer know costs, not merely estimate them from competitive or past prices.

There are various parts in the consideration of "buying at the right price" which naturally group themselves as follows:

Informative.—Past prices and markets at which purchase is made; the ammunition—compiling it for use.

Application.—Competitive prices.

Purchase at the right time.

Contract purchase.

Cost analysis.

It is a familiar fact that there should be competition between at least two different sources. However, it is advisable at times to limit the number of competing sources so that the business is of distinct advantage in point of quantity to those bidding. The practice of studying all parts of a purchase to determine the factors which contribute toward making a contract attractive to the vendor as well as to the purchaser will net dividends.

CONTRACT PURCHASING

Purchasing agents in general do not give the proper consideration to contract purchasing. By this is meant the purchase of requirements of a given article over a period of time. Contract purchase is applied, at present, to outstanding requirements, but it is applicable also to many of the day-to-day purchases. Contracts can be entered into which do not tie the buyer to any quantity, or at least afford a safe leeway, and on which discounts based on the actual quantity used over a period can be refunded at the end of the period. Office supplies, tools of almost every kind, even repair parts, are a few of the more or less unusual items which can be purchased to advantage in this way. By unusual is meant unusual for contract purchase. In this type of purchase the buyer should study carefully the company records to determine the feasibility of entering into a contract.

COST ANALYSIS

Lastly will be considered what may be termed cost analysis. In discussing here two major parts of purchase it should be realized that these are integral with other parts, such as the buying personnel and the necessity for spe-

cialists—engineers—in the purchasing department, and that these parts all go together in the application of the subjects under consideration. Emphasis cannot be placed too strongly on the necessity for "knowing" costs. Consideration of the variations in the unknown portion of the cost, and in many cases the possible factors which cause these variations, will bring the buyer to the conclusion that there are no reasons for wide variations in the differential. Consequently, over a period of time this must represent excess profit or inefficient methods. It is evident that the further this analysis is carried the more exact the results will be. Concretely, cost analysis is the method of breaking down costs for material and equipment to some common denominator, and then building up, from records and knowledge, what the cost should be. This with competitive and past prices gives, not an infallible cost, but a very excellent guide to such cost.

The method of making cost analyses and their application is briefly outlined by means of two illustrations, based on fact but changed in salient features. A piece of equipment to be purchased was of comparatively simple nature, consisting of three elements, let us say for illustration, gray iron castings, copper tubes and structural steel. The price quoted, for example, amounted to 70 cents per pound. This price was broken down into its component parts, and it was found that the castings would cost about 6 cents per pound, the copper parts about 30 cents per pound and the steel about 10 cents per pound. By weighing the pound price for each component an approximate figure of 26 cents per pound was arrived at for the cost of all the material, manufactured but unassembled. The differential of 44 cents per pound between this figure and the quoted price was quite plainly out of line. The result was a new source for furnishing this equipment, at 40 cents per pound, with a purchase dividend on the one transaction of $4,800.

Again, two purchases were made, about one year apart, of a semi-manufactured product of which the cost of raw material made up a large percentage of the total cost of the product, as follows:

	First Purchase, Cents per Lb.	Second Purchase, Quoted Price, Cents per Lb.
Price paid	22	30
Total cost of raw material at time of quotation	12	14
Differential	10	16

Labor costs over the period were virtually unchanged according to the wage indices, so there was no apparent reason for the marked increase in the differential, which in each case must represent only manufacturing cost, overhead and profit. After placing these facts before the vendor's representative a revised quotation could reasonably be expected.

This sort of analysis may be used in virtually every type of purchase. It is obvious that it will not be used except in purchases of importance or where there is no other means of obtaining adequate price data. It has been asked what good it does and how one can apply the guide when all the prices are above the estimated cost. The examples used here will give an inkling of how this can be done. In a surprising number of cases the vendor is willing to meet the buyer half way—he does not want the reputation of taking an excess profit or of inefficient methods. Patented articles or articles only purchased occasionally are exceptions. The buyer may fail to get the concession which he feels is due the first time, but eventually the price will be brought into line.

In conclusion, if a buyer uses all the means at his disposal intelligently—and "sells" his executive on the importance of his function, so that he may receive adequate assistance—in the majority of cases he can not merely know and obtain current or market prices, but actually have the fundamental knowledge of the right price under given conditions, and, provided with such knowledge, can justly, and with the maintenance of good will and sound economics, obtain that right price.

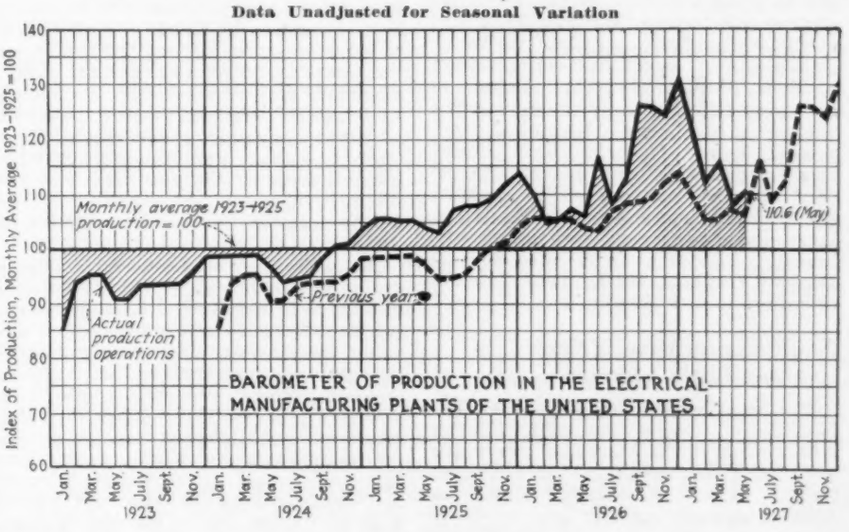
Production Increases 3.8 per Cent

Electrical Manufacturing Plants Report May Productive Activity to Have Exceeded May of Last Year in This Ratio— 2.3 per Cent Over April

THAT the productive activity of the electrical manufacturing plants of the country during May was slightly greater than during April, and considerably over that of May of last year, is indicated by reports received by the ELECTRICAL WORLD from a large percentage of these plants in all sections. The actual production of these plants during May was 1.4 per cent over April, but after corrections are made for number of working days in the two months the relative productive activity is found to have increased by 2.3 per cent. A study of production by the electrical manufacturing plants for the past four years would indicate that the usual upward trend in production at this season of the year has started a month or two sooner than in past years. May production was 3.8 per cent over that reported for May of last year, but was 15.8 per cent under that recorded for December, the peak month of production for the electrical manufacturing industry.

A study of the industrial reports on consumption of electrical energy indicates that conditions in the industry were somewhat spotty, some plants reporting increased consumption, while others reported a decreased consumption of electrical energy during May. Both the smaller and larger companies, however, when taken as groups, reported increased production over the month of April.

The productive activity which was witnessed by the electrical manufacturing plants during May was of an entirely different order from that reported for the same month by industry as a whole. While the electrical manufacturing plants were operating at 2.3 per cent above April, general industry in the country as a whole reported operations 1.4 per cent under April. On the other hand, while general production was 6.4 per cent over May of last year, production by the electrical manufacturing plants was only 3.8 per cent over May of last year. Despite the fact that the electric light and power industry has been generally recognized as one of the fastest-growing American primary industries since the war, yet apparently the production of electrical equipment, apparatus and supplies has not kept pace with the production of commodities in general. General production, however, is on a downward trend, while the production of electrical manufacturing plants is on an upward trend, so that this fall behind general industrial production is probably only temporary on the part of the electrical manufacturing industry.



Business Conditions

DESPITE quiet conditions in the industry, industrial business is in good volume in virtually the entire country and no indications of a large falling off are evident. New electrification plans are largely responsible for a number of sales. In Arkansas more than $250,000 worth of such business has been closed, and a considerable amount is pending in the Southeast. Sales of motors are holding up in good volume. With the present trend of inquiries it is quite likely that orders placed for the first six months of this year will be more than for the same period last year.

In the New England district industrial and domestic heating apparatus continues to be in demand. Sales of small steam-turbine outfits for industrial and auxiliary service have been especially active, and heavy duty domestic appliances are selling better. The industrial market is good in the New York district, but central-station buying is quiet and is mainly limited to small orders. Considerable industrial business is pending in the Southeast and sales of motors up to 100 hp. are in good volume. In the St. Louis district the center of gravity of the electrical business appears to be in Arkansas. A number of orders were received from that state. Sales are steady in the Middle West, though the volume is not large. Industrial business is spotty. On the Pacific Coast power apparatus and machinery orders included four electric locomotives amounting to more than $1,000,000. A large order for heavy-duty oil-circuit-breaker equipment was also placed. Dealers report much miscellaneous ordering.

Non-Ferrous Metal Prices Show Little Change

The non-ferrous metal market has been quiet. Copper has sold in better volume than in the preceding two weeks but the total business has not been large. Prices are steady. Lead has been somewhat quieter, and zinc has been reasonably active. Although copper sales have improved considerably over the business of the two weeks preceding there is still no sign of any important buying movement. Some companies continue to remain out of the market as they are quoting nominally 12⅝ cents for Eastern deliveries, but there are several sellers, and have been all week, who are booking orders at 12½ cents.

NEW YORK METAL MARKET PRICES

	June 16, 1927 Cents per Pound	June 23, 1927 Cents per Pound
Copper electrolytic	12¼	12¼
Lead, Am. S. & R. price	6.40	6.40
Antimony	12¼	12¼
Nickel, ingot	35	35
Zinc spots	6.60	6.525
Tin, Straits	67¼	67⅞
Aluminum, 99 per cent.	26	26

Base copper price June 23, 1927, 14¼ cents.

Though the lead market has been quiet, particularly in the East, prices have been firm. If anything sentiment is better as a consequence of the issuance of May statistics, which showed a continuation of the decline in production recorded in April. The preponderance of opinion seems to be that the present price has had the effect of discouraging production sufficiently to arrest the recent climb of stocks at smelters and refineries. The American Smelting & Refining Company has continued its official contract price in New York at 6.40 cents and it is doubtful if this has been cut by any one during the week. On the contrary some sales were made at 6.45 cents. Virtually no change has occurred in the zinc market.

Heating Equipment Active in New England District

Industrial and domestic heating apparatus continues to move well in the New England district. Inquiries and sales of small electric furnaces are very gratifying, and recent orders include more than 220 kw. in diversified units for heat-treating service in Maine, Massachusetts and Rhode Island. Sales of small motors are not so active as they were last week, but several 75-hp. machines for power-factor correction have lately been purchased. Interest is being shown in traffic signal systems and sales are trending upward. Electric signs of the gas-filled type are selling well, one house reporting orders for 35 units in the past six months in the Boston district.

No important turbo-generator orders are reported, but small steam turbine outfits for industrial and auxiliary service have been in unusually active demand this spring. Heavy-duty domestic appliances are showing better sales, and one company reports the sale of 84 electric ranges in May. Intensive sales effort is yielding good results in the refrigeration field. On the whole, electric range sales in the Boston district are running about double last year's figures. Wire and cable are moving fairly well, and there is a seasonal demand for line material. Electric air heaters for household use have not been pushed as the protracted cold weather warranted, and fan sales have been almost negligible. Small transformers and meters are selling reasonably well, interest in ironers is growing, and orders for portable lamps seem to be little affected by the long daylight hours.

Industrial Market Good in New York District

Purchase by central-station companies in the New York district are mostly limited to individually small amounts, and conditions are generally reported to be quiet. The transformer demand is confined mostly to the distribution sizes, and the market for poles, cross-arms, hardware, etc., is dull. The inquiries for quotations that are being received do not portend any immediate change in this situation. The industrial market continues good, although some decrease is reported in the demand for small motors. This is offset by an increase in sales of motors of medium size, ranging from 5 hp. to 25 hp. Control apparatus and transformers are finding a fair market among industrial buyers.

Considerable Industrial Business Pending in Southeast

Steady rains over the Southeast have considerably improved crop conditions and have lent a more optimistic tone to the rural sections, but little activity in that field is noted. The largest individual order placed was by a central-station company for large power transformers amounting to approximately $70,000, while another power company order called for $30,000 worth of motor and control equipment for Florida delivery. An order from the Alabama territory called for $6,000 worth of stokers, while another from Georgia called for industrial truck batteries amounting to $3,000. Central-station inquiries on substation equipment and purchases of small distribution transformers and house-type meters are reported satisfactory.

Industrial purchases recently are almost entirely reflected in orders for motors up to 100 hp., which are coming through in reasonably good volume, but there is considerable industrial business pending and on which announcements will probably be made in the near future. A Georgia textile plant ordered 100 "whiteway" posts for installation in its mill village. The purchase of a fleet of twelve industrial trucks for use in a Florida city is pending, and orders are expected to be placed in the immediate future. Electrical appliances, particularly ranges and refrigerators, are moving briskly. A power company in the Carolinas recently closed a range campaign in which 1,824 ranges were sold in a six-week period, while a group of affiliated companies in the western portion of the territory recently sold 1,435 ranges in a six-weeks campaign.

Steady Sales in Middle West But Volume Not Large

No improvement in business conditions appears likely in the Middle West section this month. While a steady volume of business is being transacted it is not large. Industrial activity continues spotty and the reduction of output in the steel industry is not encouraging. The various utility companies are continuing their conservative policy with regard to future commitments and reduction of labor, although some purchasing of apparatus is going on. An interesting order for the construction of a Gate House for a utility in this section and another for a large amount of fabricated steel were placed this week, together with two motor-driven heater condensate pumps, and a "Hydrojet" sluicing equipment for one reheat and two normal boilers. There has been a steady demand for distribution materials and maintenance purchases are quite large.

Jobbers' sales have been virtually the same. Quite a large amount of municipal business is being placed but the volume of all sales has been materially reduced owing to the spotty industrial activity. Appliances of the gift type are moving in fair volume but appliances as a whole are not particularly active. Concurrent campaigns on ventilation equipment, particularly kitchen ventilators, has resulted in good business. Manufacturers of lead-covered wires and cables reduced their prices approximately 5 per cent.

Large Orders from Arkansas Feature Sales in St. Louis District

The center of gravity of the electrical business in the St. Louis district appears to be in Arkansas. One order for 50 motors of 75 hp. and 100 hp. for driving cotton gins has been placed by one of the large Arkansas power distributing companies. An order also has been placed for 38 motors, aggregating 2,400 hp., by a large cottonseed-oil mill in the central part of Arkansas. A contract for motors and switchboard with equipment of instruments and oil switches, amounting to considerably over $100,000, has been closed with a large paper mill in southern Arkansas. Manufacturers of small motors report the volume of orders holding up, with indications that the first six months' business will be above that of the same period for last year. Central-station buying has not included any very large orders for machinery, but the sales of appliances have been pushed and the results are said to have been exceptionally satisfactory.

Large Electric Locomotive Order Placed on Pacific Coast

Power apparatus and machinery orders on the Pacific Coast include such items as six heavy-duty oil circuit breakers for the East Bay district, amounting to $7,000; sixteen 2,000-amp., 15,000-volt heavy-duty circuit breakers, valued at $55,000; a group of 150-kva. regulators for distribution over a central and northern California system, amounting to $75,000, and ten assorted oil-well drilling and pumping motors in sizes from 35 hp. to 15 hp. Power-company purchasing of supplies consisted mainly of small miscellaneous orders for maintenance, but this class of business also is expected to be much better during the last six months of the year. Four carloads of fiber conduit have been ordered by the city of San Francisco for its Sunset traffic tunnel. Dealers report much miscellaneous ordering. Railroad buying has been slow, but jobbers state that many requests for quotations promise better business in the near future.

Four electric locomotives were purchased by the Great Northern Railway Company at a cost of more than $1,000,000. These locomotives are for use on the electrified division over the Cascade Mountains. An order was also placed for four locomotives of 6-ton and 10-ton capacity for use in the construction of the 17-mile Winton cut-off near Leavenworth, Wash. Contracts for machinery and motor equipment for a 1,500-barrel cement plant at Grotto, Wash., were placed and amounted to about $100,000. Other orders included five 25-hp. motors for a grain elevator, seventeen motors from 125 hp. down for an Everett lumber mill, five 1,000-hp. motors, one 625-kw. generator, three 2,000-kw. transformers and one 75-kw. and one 30-kw. motor-generator set for an Oregon pulp and paper mill. Specifications for machinery and motors for a half-million-dollar pulp mill for a Northwest pulp and paper company at Tacoma, Wash., are expected to be placed soon with manufacturers.

Activities of the Trade

Westinghouse Stockholders Meet and Elect Directors

At the annual meeting of the stockholders of the Westinghouse Electric & Manufacturing Company, held this month at the East Pittsburgh headquarters of the company, President E. M. Herr in his report called attention to a decrease in the funded debt of the company by the payment of $6,000,000 Westinghouse Machine Company bonds and the refunding of $30,000,000 of electric company bonds from 7 per cent to 5 per cent, which materially reduces the fixed charges of the company. In discussing the business status Mr. Herr said: "Business conditions are rather quieter than at the same time last year, but owing to continuing development the electrical business is, on the whole, better than general business. Indications are that the volume of business will maintain about its present level." W. L. Mellon, president of the Gulf Oil Corporation, was elected to fill a place on the board made vacant by the resignation of R. B. Mellon, president of the Mellon National Bank. The term expires in June, 1930. Four directors whose terms expired were re-elected. They were James C. Bennett, comptroller of the Westinghouse company; Samuel M. Vauclain, president Baldwin Locomotive Works; E. M. Herr, president Westinghouse company, and L. A. Osborne, president Westinghouse Electric International Company.

Graybar Electric to Distribute Creosoted Pine Poles

An alliance of the Graybar Electric Company with the International Creosoting & Construction Company of Galveston, Tex., has just been effected. With a few territorial exceptions the Graybar company will take over the country-wide distribution of International creosoted Southern pine poles through all of its 61 distributing houses. With the recent completion of additions to its pole-treating equipment the International company has doubled its plant capacity.

Sangamo Electric to Offer New Issue of Stock

An issue of $1,000,000 of 7 per cent cumulative preferred stock of the Sangamo Electric Company, Springfield, Ill., was offered this week by Kissel, Kinnicutt & Company and Paul H. Davis & Company of Chicago. No new financing is involved. The stock was offered at $101 per share plus accrued dividend to yield 6.93 per cent.

The company, incorporated in Illinois in 1899, manufactures alternating and direct-current watt-hour and ampere-hour meters and auxiliary equipment. R. C. Lanphier, president of the company, in a letter to the bankers states that the organization has reported profits in every year of the past fifteen, including the years of general business depression of 1920 and 1921. The following net earnings after the deduction of taxes and appreciation were applicable to dividends on the present issue of preferred stock: 1922, $441,381.76; 1923, $610,336.70; 1924, $484,043.55; 1925, $531,761.43; 1926, $594,930.91.

Rex Cole, Inc., distributor for General Electric refrigerators, on June 24 opened permanent display rooms at 7 East 45th Street, New York.

The Foos Gas Engine Company, Springfield, Ohio, at a meeting of its board of directors this month elected J. F. Baker president and M. E. Baker secretary-treasurer. The company appointed Ray C. Burrus sales manager, W. W. Schettler chief engineer and George F. Noltoin mechanical engineer. It was also decided to change the name of the company to the Foos Engine Company. The new program of the company includes the establishment of a factory branch at Tulsa, Okla.

The Everstick Anchor Company, St. Louis, announces that J. C. Asher will represent the company in the Southeast in promoting the sale of its line construction specialties. Mr. Asher for the past 21 years has been associated with the Southern Bell Telephone Company and recently has been chief foreman of construction in the Atlanta district.

The Edison Lamp Works of the General Electric Company, Harrison, N. J., announces that W. M. States has been appointed district sales manager at Chicago, with offices at 230 South Clark Street.

The Link-Belt Company, 910 South Michigan Avenue, Chicago, announces that R. P. Shimmin has been appointed assistant to the chairman and the president and will hereafter make his headquarters at the executive offices at Chicago, and also that Frank B. Caldwell has been appointed sales manager with headquarters at the Chicago plant office, 300 West Pershing Road. Mr. Caldwell will have supervision over all sales activities in the Western division.

The General Electric Company has announced a reduction in the prices of lightning arresters. Arresters for transmission voltages up to 73,000 volts

are reduced approximately 4 per cent, for 110,000 volts and higher 10 per cent and for distribution circuits from 3 per cent to 7 per cent.

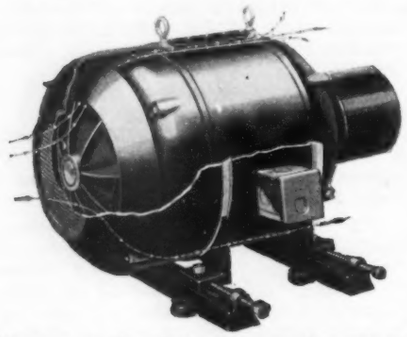
The Corning Glass Works, Corning, N. Y., announce the opening of a sales office at 369 Lexington Avenue, New York, under the direction of Raymond W. Lillie, formerly of the R. W. Lillie Corporation, to handle the exclusive sales of "Pyrex" power insulators for the United States and Canada. W. H. Taubert, formerly of the R. W. Lillie Corporation and later with the American Brown Boveri Corporation, has again become associated with Mr. Lillie in the furtherance of the sales of Pyrex power insulators in the United States and Canada.

The Black & Decker Manufacturing Company, Towson, Md., has developed a new line of electric tools driven by three-phase, squirrel-cage motors operating on 180-cycle current.

New Equipment Available

Inclosed Self-Ventilating Motor

A totally inclosed, self-ventilating Howell "Red Band" motor has been placed on the market by the Howell Electric Motors Company, Howell, Mich. The manufacturer claims that this new motor is fireproof, oilproof, dustproof, waterproof, fume and acid proof. It is equipped with Timken tapered roller bearings fitted with the Howell automatic bearing adjuster. The motor, as shown in the illustration, is a completely inclosed standard motor surrounded by a shell which allows about ½-in. clearance between the shell and the motor, through which air is forced at a high velocity by means of a fan mounted on the motor shaft.



METHOD OF EXTERNAL COOLING APPLIED IN HOWELL TOTALLY INCLOSED MOTOR

Crane Trolley

A new standard-type crane trolley utilizing a steel plate and angle construction for the frame and steel tubing for the axle brackets, and which also incorporates the basic features of the company's previous designs, including balanced drive, straight-line construction in units each separately accessible and automatic oil bath lubrication, has been placed on the market by the Shepard Electric Crane & Hoist Company, Montour Falls, N. Y. Sectionalized construction is said to permit each trolley to be built up of units suitable for the service intended. Seven distinct types of crane trolleys are available in the new design.

In developing this new design clearances have been made as small as possible, providing a compact trolley. A special low-headroom type is available for use where overhead clearances are extremely limited. Two optional types of mounting for the hoist motor are provided. The field frame of the motor may be bolted to an adapter, or the base of the motor may be bolted to a horizontal shelf. The trolley motor like the hoist motor may be mounted by bolting its field frame to an adapter or, as an alternative, upon its feet on a shelf near the center of the driven-axle bracket. Any type of motor solid or split frame of appropriate size may be used.

Distribution Transformers for Industrial Application

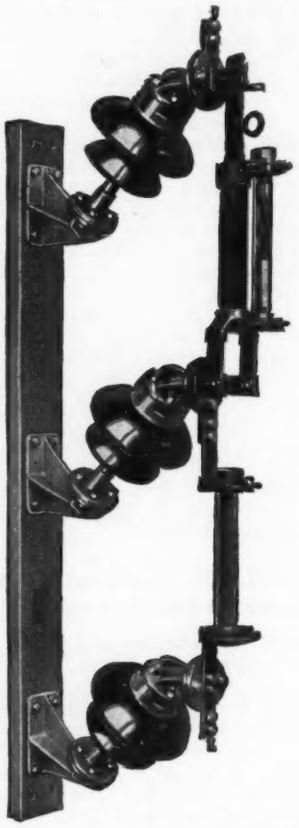
The types SB and SKB distribution transformers, which have been designed for industrial application and to withstand severe conditions of vibration and handling, have been placed on the market by the Westinghouse E'ectric & Manufacturing Company. The coils and iron in the tank are protected with extra-heavy bracing, and the manufacturer claims that with the tank construction the transformer may be made absolutely oil-tight. This transformer makes it possible to have stock transformers completely filled with oil and ready for immediate use without the danger of any oil leaking or splashing out in transportation.

"Disconnect" for Protection of Potential Transformers

A fuse, current-limiting resistor and disconnecting switch combination on a single mounting, which is intended for the protection of potential transformer installations, has been developed by Schweitzer & Conrad, Inc., 4421 Ravenswood Avenue, Chicago. The unit is made to accommodate the S. & C. type DLC fuse and the S. & C. wire-wound resistor. The combination outdoor use is shown in the illustration, but the unit is also available in a type suitable for indoor use.

The fuse for use in this combination is a special form of S. & C. fuse, designated as the type DLC. The manufacturer claims that in this new fuse high interrupting capacity is combined with extremely low current rating. For example, at 13,200 volts the type DLC fuse has an interrupting capacity of 7,000 amp., while the current rating is 0.5 amp. The manufacturer states that this fuse can be depended upon to blow at 0.8 amp. and thus protects potential transformers against failure resulting from short circuits at secondary terminals. The low rating of this fuse was achieved by the application of a compound lever arrangement to hold the heavy coil spring under tension and at the same time transmit only one one-hundredth of this tension to the tiny fuse element. The manufacturer states that mechanically the type DLC fuse is as strong as a 100-amp. fuse.

The resistor used in the disconnecting combination is also a new form for limiting the short-circuit current in case of potential transformer bushing or winding failure. It consists of a helical coil of nickel-chromium resistance wire, wound on a core of wet process porcelain, and the whole is inclosed in a glass tube with a brass ferrule at each end. The glass tube is used to make it weatherproof and also allows inspection of the interior without removing the resistor from service.



FUSE, RESISTOR AND DISCONNECTING COMBINATION FOR OUTDOOR USE

High-Capacity Disconnecting Switch

A new type of 6,000-amp., 7,500-volt high-capacity disconnecting switch for either indoor or outdoor service has been developed by the Delta-Star Electric Company, 2400 Block, Fulton Street, Chicago. The flanged insulators are provided with corrugations on the under side, giving a long leakage surface to ground. The top terminal lugs are designed for attaching to bars lying in a vertical position, and the lower lugs are designed for use with horizontal bars. A positive safety lock prevents the blades being forced open by the magnetic effects of heavy surges.

New Trade Publications

ELECTRIC EQUIPMENT. — Bulletin GEA-753 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its CR9511 shoe-type solenoid brakes. The company is also distributing bulletin GEA-751, covering the "G-E" combination trolley wire suspension and guard board support for mines.

CONCRETE MIXING PLANTS. — The Blaw-Knox Company, Pittsburgh, has issued a catalog entitled "Inundation Central Mixing Plants for Mechanical Control of Water-Cement Ratio and Production of Constant Concrete," covering the Blaw-Knox inundation system. Numerous illustrations are given showing various applications of the system in concrete building construction and the various types of equipment used. Drawings showing the Blaw-Knox inundation central mixing plant and operation of the inundation system are included.

OVERHEAD CONSTRUCTION MATERIALS.—A leaflet distributed by the Copperweld Steel Company, Braddock P. O., Rankin, Pa., entitled "Overhead Construction Materials" calls attention to the advantages of "Copperweld" products for overhead construction.

INCLOSED INDUCTION MOTOR. — Bulletin No. 1133 issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes its new totally inclosed, nonventilated, squirrel-cage induction motor. Illustrations showing details of construction and dimension table are included.

STORAGE TANKS. — "Bulk Storage Tanks" is the title of a new catalog issued by the Graver Corporation, East Chicago, Ind., giving information on bulk storage installations. It contains illustrations of various types of tanks and a list of standardized sizes with specifications for all types.

MATERIAL-HANDLING EQUIPMENT. —The Lewis-Shepard Company, Watertown Station, Boston, is distributing its "Jacklift and Stacker Practice" for 1927, in which it describes and illustrates a series of labor-saving machines designed and built by the company. Special attention is called to the improved practice in material handling by "jacklifts" and "stackers."

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

SALEM, MASS. — Authority has been granted the Eastern Massachusetts Electric Company to erect transmission lines on the right-of-way formerly held by the Boston & Maine Railroad Company from Salem to Haverhill and Newburyport, a distance of about 76 miles. The purpose of the proposed line is to connect the lines and plants of the Haverhill Electric Company and the Newburyport Gas & Electric Company with the plant of the Salem Electric Lighting Company.

HARTFORD, CONN.—Plans have been filed by the Edwin Taylor Lumber Company for a substation at 108 Charter Oak Avenue, to supply electric service at its mill.

Middle Atlantic States

LONG LAKE, N. Y. — Permission has been granted the Long Lake Light, Heat & Power Company to build an electric plant in Long Lake. The company was also authorized to issue $20,000 in capital stock.

NIAGARA FALLS, N. Y.—Bids will be taken at once by the Certain-Teed Products Corporation, 100 East Forty-second Street, New York, for a power plant at its local factory, to cost about $50,000. Klipstein & Rathman, 346 North Eighth Street, St. Louis, are architects.

UNION CITY, N. J.—The City Council is considering extensions in the fire-alarm system to cost about $75,000.

HARRISBURG, PA.—Bids will be received by Frank C. Foose, purchasing agent, Harrisburg School District, until July 1, for electric shop equipment for the vocational departments of local schools.

PHILADELPHIA, PA. — The Pennsylvania Railroad Company, Broad Street Station, has plans for several power substations on its Wilmington branch, in connection with the electrification of that line.

VIENNA, MD. — Permission has been granted the Delmarva Power Company, a subsidiary of the Eastern Shore Gas & Electric Company, to build a power plant at Vienna, to cost about $1,000,000.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until July 6, for electric motor, refrigerating apparatus and other equipment (Panama Circular 1810).

North Central States

WHITLEY, KY.—A preliminary permit has been granted Edward Allen, Room 711, 111 West Jackson Boulevard, Chicago, for the construction of a hydro-electric plant on the South Fork of the Cumberland River. The plans provide for an initial development of 60,000 hp. and ultimate output of 130,000 hp., to cost about $1,500,000, with transmission system.

CHICAGO, ILL.—The finance committee of the City Council has appropriated $1,700,000 for new street lamps and $100,000 for traffic signal lamps.

PEORIA, ILL.—The installation of an ornamental lighting system on South Adams Street, and ten additional traffic signals, to cost about $10,000 is under consideration. W. E. Backus, City Hall, is engineer.

KEOKUK, IOWA.—The proposed addition to the Keokuk plant of the Mississippi River Power Company, to cost about $2,500,000, has been indefinitely postponed.

MUSCATINE, IOWA. — The Municipal Lighting Department plans to install an ornamental lighting system in Weed Park, requiring about fifty standards. The installation of an ornamental lighting system on Front, Second and Third Streets, between Mulberry Avenue and Pine Street is under consideration.

CLINTON, MO.—Plans are under way by the West Missouri Power Company, Pleasant Hill, to increase the output of its local plant from 3,000 hp. to 8,000 hp. The cost is estimated at $400,000.

ST. LOUIS, MO.—The Southwestern Bell Telephone Company plans to build about 6 miles of underground cable between main office, at Eleventh and Pine Streets, and the Cabany Exchange, to cost about $72,500.

HAMILTON, N. D. — The Otter Tail Power Company, Fergus Falls, Minn., plans to erect a transmission line from Cavalier to Hamilton, for local service.

DIXON, NEB. — Authority has been granted the Interstate Power Company, Dubuque, by the State Railway Commission to eerct a transmission line from Dixon and Concord to serve electricity in Concord.

NORTH LOUP, NEB. — The Nebraska Electric Power Company, Omaha, has abanboned the municipal power plant, recently purchased, and will supply current from its central generating station at Loup City. The company has purchased the hydro-electric plant at Ericson and will extend its transmission line to that town.

OMAHA, NEB.—Plans have been filed by the Nebraska Power Company for the construction of a substation at Twenty-fourth and M Streets, to cost about $21,000.

Southern States

NEW LONDON, N. C.—The Southern Public Utilities Company, Charlotte, which has acquired the municipal electric plant, plans to erect a high-tension line, 10 miles long and improve the local service. The company also plans to furnish electric service in Richfield, Meisenheimer and Isenhour.

SALISBURY, N. C. — The Southern Power Company, Charlotte, plans to rebuild its local substation recently damaged by fire with loss of about $21,000.

GREENWOOD, S. C. — The Savannah River Electric Company has applied to the Federal Power Commission for a license to construct a dam and power house on the Savannah River in McCormick County, to develop about 34,000 hp.

OCALA, FLA.—A preliminary permit has been granted the Florida Power Company by the Federal Power Commission for the construction of a dam and a power house at Donegan's Mill on the Sante Fe River in Alachua and Columbia Counties.

CHATTANOOGA, TENN.—Bids will be received by the Department of Streets and Sewers, Chattanooga, until July 10 for pumping machinery, electric motors, etc., in connection with a pumping plant for the municipal waterworks.

NEW ORLEANS, LA.—The adoption of a new type of ornamental lamps for lighting all the boulevards of the city has been recommended to the City Council.

OKLAHOMA CITY, OKLA.—Preliminary plans are being prepared by E. W. Baker & Company, 414 Medical Arts Building, for the erection of a 13,200-volt transmission line from Wanette to Lexington, 10 miles long, and a distribution system in Lexington, to cost about $30,000. The company also plans to erect a 22,000-volt line from Wanette to Byars, a distance of 12 miles, and a distribution system in Byars, to about $10,000.

FREEPORT, TEX.—The Houston (Tex.) Lighting & Power Company has acquired the property of the Freeport Light, Water & Ice Company with the exception of the plants at Bryan Mound and Hoskins Mound.

HOUSTON, TEX.—The Houston Lighting & Power Company has applied for a franchise to build a transmission line from Kemah and Friendswood.

KINGSLAND, TEX. — Application has been made to the Federal Power Commission by the Syndicate Power Company, Dallas, for authority to build a dam on the Colorado River near Kingsland. The company has obtained rights for a series of six dams on the Colorado of Texas. The other five dams are to be located as follows: One 2½ miles from Kingsland, one 18 miles from Lampasas, one 14 miles above Austin, another 15½ miles above Austin, and the fifth 1½ miles from Marble Falls. The cost of the projects is estimated at $15,000,000.

LAREDO, TEX.—Bids will be received by the Central Power & Light Company, Frost Building, San Antonio, until July 8, for an electric-operated pumping station for its water supply system at this place.

SIERRA BLANCA, TEX.—The El Paso Electric Company, El Paso, is planning to build a steam-operated electric plant here.

Pacific and Mountain States

MORTON, WASH.—The City Council is considering a bond issue of $35,000, the proceeds to be used to build a transmission line from Morton to La Grande to connect with the Tacoma municipal electric plant there, and to install a local electric distributing system.

WHITE SWAN, WASH. — The Pacific Power & Light Company, Seattle, plans to extend its transmission line to White Swan to serve the entire Fort Simcoe district.

LA GRANDE, ORE. — The American Nitrogen Products Company plans to install electric power equipment in connection with the rebuilding of its plant, recently damaged by fire with loss of about $300,000.

PORTLAND, ORE.—The Sherman Electric Company has applied to the Federal Power Commission for a license covering about 75 miles of transmission line to connect the towns of De Moss Springs, Condon and Arlington.

LAKEPORT, CAL.—Surveys are being made by the Pacific Gas & Electric Company for the erection of a 60,000-volt transmission line between Hopland and Lakeport to connect with a substation near the Highland Springs junction to serve the Lakeport section. The Kelseyville lines will be rebuilt and a new line will be extended into the Lower Lake section. The cost of the work is estimated at $250,000.

MARYSVILLE, CAL.—A permit has been granted the Gold Basis Mining & Milling Company, Oakland, to build a hydro-electric plant on the Yuba River, to cost about $45,000.

SIERRA CITY, CAL.—Permission has been granted E. O. Carvin, Sierra City to build a hydro-electric plant on the Yuba River, to cost about $30,000.

WATSONVILLE, CAL.—Plans are under way by the Growers' Cold Storage Company for the construction of an ice and cold storage plant, to cost about $200,000. The Austin Company, 244 Kearny Street, San Francisco, is engineer.

SALT LAKE CITY, UTAH.—The City Commission has authorized the installation of an ornamental lighting system on West Temple and South Temple Streets, to cost about $10,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued May 31, 1927)

1,630,668. METHOD OF CONNECTING TWO MEMBERS WHICH ARE NOT ADAPTED TO BE WELDED TOGETHER; F. Mossberg, Attleboro, Mass. App. filed Nov. 1, 1921. By a spot-welding process.

1,630,679. ELECTRIC-LAMP SOCKET; D. N. Thompson, Syracuse, N. Y. App. filed July 23, 1920.

1,630,757. FIELD WINDING; L. M. Perkins, Syracuse, N. Y. App. filed April 13, 1922. A field winding for a multipolar machine, which winding can be produced in a single operation.

1,630,764. SIGNAL TRANSMITTER; F. Rizzo, Schenectady, N. Y. App. filed Feb. 27, 1925.

1,630,808. ALARM DEVICE; E. T. Siegerdt, Chicago, Ill. App. filed Nov. 27, 1925. Adapted to be used in connection with wire screens.

1,630,823. ELECTRICAL REGULATING APPARATUS; E. J. Blake, Buffalo, N. Y. App. filed Jan. 3, 1923. For electrical generators driven at variable speed as from the axle of a railway car.

1,630,866. ELECTRIC BUTT-SEAM WELDING AND APPARATUS THEREFOR; F. L. Sessions, Lakewood, Ohio. App. filed Nov. 5, 1925.

1,630,884. ELECTRICAL INDICATING INSTRUMENT; J. R. Barnhart, Lakewood, Ohio. App. filed March 8, 1922. Alternating-current voltmeters and ammeters.

1,630,896. ATTACHMENT PLUG; W. Herskovitz, Chicago, Ill. App. filed Feb. 24, 1925.

1,630,908. ELECTRICAL MEASURING INSTRUMENT; W. M. Scott and R. E. Tresise, Cleveland, Ohio. App. filed Jan. 7, 1922. Ampere-hour meter.

1,630,909. ELECTRIC WATER HEATER; E. C. Steere, Sydney, New South Wales, Australia. App. filed Nov. 19, 1925.

1,630,914. FOOT-RAIL CONTACTOR FOR ELECTRIC BURGLAR-ALARM SYSTEMS; J. P. Williams, Bayside, N. Y. App. filed April 8, 1925.

1,630,936. ELECTRIC FITTING; C. E. Godley, Detroit, Mich. App. filed April 10, 1924. Connector type.

1,630,940. ELECTRIC PREHEATER FOR VAPOR BURNERS; G. A. Hoffman, Mansfield, Ohio. App. filed Nov. 18, 1926.

1,630,952. SPRING-RETRACTED ELECTRIC CIGAR LIGHTER; W. Leschman, Chicago, Ill. App. filed Dec. 6, 1923.

1,630,989. ELECTRICAL MEASURING INSTRUMENT OF THE TYPE EMPLOYING A MOTOR CONTROL; B. Usigli, Milan, Italy. App. filed Sept. 7, 1926.

1,630,990. SOLDERING IRON; H. A. Wagg, Wapello, Iowa. App. filed Oct. 20, 1926.

1,631,001. SWITCH; A. E. Bost, Waelder, Tex. App. filed Oct. 13, 1923. With means for breaking the circuit automatically when the position of the switch is changed, as on tractors which have a tendency to rear up when the strain on the drawbar reaches a certain degree.

1,631,012. SWITCH; N. J. Conrad, Chicago, Ill. App. filed Dec. 12, 1925. Air-break switch. Using an electric fuse of high current rupturing capacity as a means of suppressing the arc at the contacts when the switch is opened.

1,631,024. ELECTRIC CIRCUIT-CONTROLLING APPARATUS; S. G. Fisher, Boston, Mass. App. filed Dec. 27, 1924. A mechanism for indicating certain predetermined bin or bunker levels of semi-solid materials, such as pulverized coal.

1,631,025. CURRENT-THEFT INDICATOR; O. Flener, Fort Smith, Ark. App. filed Dec. 23, 1925. An instrument adapted to be built into or combined with an electric current meter.

1,631,054. SWITCH; B. Palm, Washington, D. C. App. filed Feb. 4, 1926. For use in connection with elevators or the like.

1,631,085. ELECTRICAL APPARATUS; T. W. Case, Auburn, N. Y. App. filed April 16, 1923. For translating sound waves into light waves or variations of light waves.

1,631,102. STARTING SWITCH FOR SINGLE-PHASE MOTORS; R. C. Leake, Rochester, N. Y. App. filed Aug. 17, 1920.

(Issued June 7, 1927)

1,631,168. RHEOSTAT; A. E. Waller, Bronxville, N. Y. App. filed May 7, 1924. Plate type.

1,631,178. COMBINATION SOCKET-SEATING AND FUSE-TESTING BLOCK; W. Wurdack, St. Louis, Mo. App. filed Dec. 31, 1923.

1,631,186. METHOD OF BUILDING DYNAMO-ELECTRIC MACHINE ARMATURES AND WINDINGS FOR SAME; V. G. Apple, Dayton, Ohio. App. filed Sept. 22, 1924. In which a single unit comprises a commutator bar and a turn of the winding integral.

1,631,200. DRY CELL; W. F. Hendry, Ossining, N. Y. App. filed Nov. 8, 1923. Manner of preparing the depolarizing mix for dry cells.

1,631,224. ELECTRICAL CONDUIT-CROSSOVER SYSTEM; J. Schilz, Los Angeles, Cal. App. filed Aug. 19, 1925.

1,631,268. ELECTRICAL SWITCH; E. H. Jacobs, Chicago, Ill. App. filed May 14, 1920. The protection of electrical switch contacts which are exposed to severe weather conditions.

1,631,288. GROUND-CLAMP CONNECTOR; E. F. Potter, Glencoe, Ill. App. filed June 7, 1923.

1,631,377. SEALING-OFF DEVICE; W. W. Loebe and M. Grossmann, Berlin, Germany. App. filed Feb. 20, 1925. For vacuum and gas-filled incandescent lamps.

1,631,378. SEALING-OFF DEVICE; C. Martin, Kearny, N. J. App. filed June 4, 1923. For vacuum vessels as incandescent lamps.

1,631,379. SEALING-OFF TORCH; L. A. Maurer, Irvington, N. J. App. filed June 4, 1923. For evacuated devices.

1,631,461. COMMUTATOR AND METHOD OF MAKING SAME; L. Bonsieur, Elyria, Ohio. App. filed Dec. 1, 1924.

1,631,474. MUFFLE FURNACE; E. A. Colby, Maplewood, N. J.; F. Maeulen, East Orange, N. J., and G. L. Van Allen, Newark, N. J. App. filed July 12, 1926. For use in making artificial teeth.

1,631,484. ELECTRIC HEATER; W. E. Hudson, Amagansett, N. Y. App. filed March 30, 1925. For buildings, railway cars, etc.

1,631,485. ELECTRIC HEATING SYSTEM; W. E. Hudson, Amagansett, N. Y. App. filed March 5, 1924. For domestic water heating.

1,631,493. REFRACTORY METAL PRODUCT AND PROCESS OF MAKING SAME; C. A. Laise, Toledo, Ohio. App. filed April 18, 1924. Filament production.

1,631,503. QUICK-BREAK SWITCH; J. H. Pengilly, Los Angeles, Cal. App. filed June 29, 1925.

1,631,507. OUTLET RECEPTACLE; H. E. Slade, Newark, N. J. App. filed Feb. 16, 1924.

1,631,511. STORAGE BATTERY; R. C. Benner, Bayside, N. Y. App. filed Feb. 29, 1924.

1,631,514. CIGARETTE LIGHTER; D. S. Brush and A. P. Brush, Greenwich, Conn. App. filed Nov. 26, 1926. Six-volt type.

1,631,528. DRY CELL; W. F. Hendry, Ossining, N. Y. App. filed Jan. 23, 1924.

1,631,550. ELECTRICAL CONNECTION; P. Roberg, Elmhurst, N. Y. App. filed Aug. 26, 1921. Flexible cable connection for commutator brushes.

1,631,555. TERMINAL PROTECTIVE APPARATUS; E. A. Seward and E. B. Rodgers, Columbus, Ga. App. filed March 24, 1923. Secondary battery terminals.

1,631,568. DRY BATTERY; V. Yngve, South Orange, N. J. App. filed May 3, 1924. Multiple-cell type.

1,631,574. SYSTEM OF ELECTRICAL SUPPLY; H. Benit, Paris, France. App. filed Nov. 9, 1923. Farm-lighting plant.

1,631,575. ELECTRICAL CONNECTION; C. C. Berry, Valley Park, Mo. App. filed Sept. 29, 1923. Swiveling connection.

1,631,614. HEATING DEVICE; H. W. Atwood, Portland, Ore. App. filed July 13, 1925. Electric plate.

1,631,642. POSITIVE ELECTRODE FOR ELECTRIC BATTERIES; R. Oppenheim, Levallois-Perret, France. App. filed Jan. 3, 1925.

1,631,644. TIME-OPERATED CIRCUIT CLOSER; G. F. Rauch, Pukwana, S. D. App. filed May 19, 1925.

1,631,645. ILLUMINATING AND HEATING DEVICE; J. J. Rekar, Los Angeles, Cal. App. filed Jan. 31, 1925. Combined portable electric heater and lamp.

1,631,665. ELECTRIC CONDENSER; W. R. Baker, Schenectady, N. Y. App. filed Feb. 7, 1921. For use on high-voltage circuits.

1,631,667. ELECTRIC FURNACE SYSTEM; J. Beckmann, Charlottenburg, Germany. App. filed March 3, 1927. High-frequency electric furnace system.

1,631,669. ELECTRIC FUSE; G. R. Brown, Bridgeport, Conn. App. filed June 13, 1924. Having longitudinal apertures of differing lengths to provide multiple bars of differing conductive capacities.

1,631,673. MOTOR-CONTROL SYSTEM; J. Eaton, Schenectady, N. Y. App. filed Sept. 26, 1925. For electric elevators.

1,631,679. THERMAL RELAY; C. I. Hall, Fort Wayne, Ind. App. filed Dec. 16, 1924. For controlling the load on an electric generator to protect it from overheating.

1,631,681. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed Nov. 20, 1922. Oil circuit breaker with switch contacts near the bottom of the tank where it is subjected to hydrostatic pressure which assists in extinguishing it.

1,631,684. ELECTRIC METER COVER; J. L. Hoyle, New Orleans, La. App. filed Nov. 2, 1925.

1,631,713. MERCURY-TUBE SWITCH; H. E. Warren, Ashland, Mass. App. filed Sept. 21, 1923.

1,631,715. SYSTEM OF DISTRIBUTION; T. F. Barton, Schenectady, N. Y. App. filed March 30, 1923. Permits a plurality of machines having the characteristics of rotary converters when operated in parallel to be connected between a common direct-current system and a plurality of alternating-current systems of different frequencies.

1,631,719. CONNECTING DEVICE; H. P. Chandler, Mansfield, Ohio. App. filed March 20, 1924. For cable connection.

1,631,726. PROTECTIVE DEVICE FOR DYNAMO-ELECTRIC MACHINES; H. C. Hastings and C. J. Sarjeant, Rugby, England. App. filed Nov. 13, 1923. Means for automatically changing the calibration of the circuit breaker of a feeder where one or more machines are required to run in parallel and supply current through the circuit breaker; applicable to automatic substations.

1,631,729. CERAMIC INSULATING MATERIAL; J. A. Jeffrey and E. T. Montgomery, Detroit, Mich. App. filed Feb. 24, 1919.

1,631,737. DYNAMO-ELECTRIC MACHINE; E. R. Knight, Norwood, Ohio. App. filed April 17, 1922. Wherein a laminated core is held in assembled condition between end heads or plates without the necessity of the ordinary yoke surrounding the laminations.

1,631,752. AUTOMATIC LOAD EQUALIZATION; W. E. Merrill, Schenectady, N. Y. App. filed Jan. 22, 1927. Whereby a desirable distribution of load between the respective motors is automatically maintained, provision being made so that the speeds of the motors may be varied within reasonable limits at the will of the operator and the predetermined load distribution between the motors automatically maintained.

1,631,753. ELECTRIC HEATER; B. Midulia, Wilkinsburg, Pa. App. filed Aug. 17, 1926. For attaching to a spigot.

1,631,765. COOLING ELECTRIC MACHINERY; R. Rudenberg, Berlin-Charlottenburg, Germany. App. filed Aug. 23, 1921.

1,631,801. ELECTROMAGNETIC DEVICE PRODUCING A CONSTANT MOVING FORCE; A. Epitaux, Paris, France. App. filed Aug. 22, 1925. For use in apparatus which need only a feeble moving force, but which force is continuous.

1,631,836. THERMOSENSITIVE RELAY; L. E. Spray, Wilkinsburg, Pa. App. filed Sept. 26, 1922.

1,631,841. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed Nov. 4, 1924. Of the push-bar type, by which a snap make-and-break action is effected.

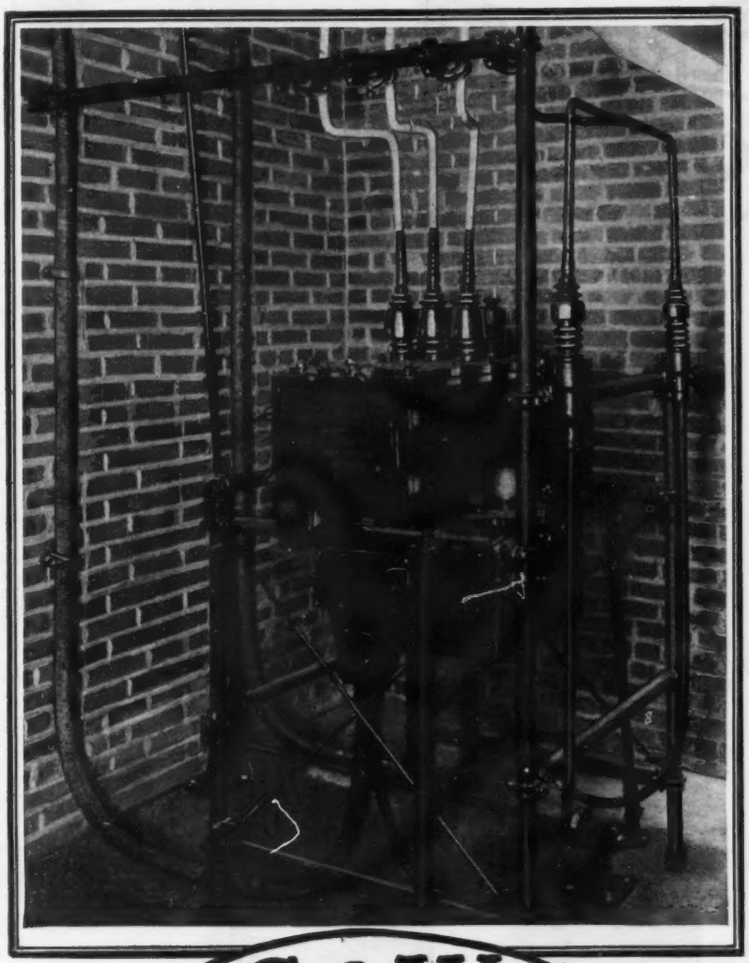
1,631,851. FUSE; C. E. Bennett, Decatur, Ga. App. filed Sept. 23, 1926. High potential suitable for voltages up to about 44,000.

1,631,867. WOODEN BATTERY SEPARATOR; E. S. Humboldt, Oakland, Cal. App. filed Aug. 28, 1924.

1,631,913. ELECTRIC SWITCH; G. A. Burnham, Sagus, Mass. App. filed July 3, 1922. Adapted to the control of small induction motors; oil-immersed type.

1,631,914. ELECTRICAL CONNECTOR; M. U. Caillau, Billancourt, France. App. filed Sept. 26, 1924. Wire connectors of tongs-like form.

Maximum Continuity of Service With a Full Measure of Safety—



G&W TRANSFORMER VAULT UNIT

The G & W Transformer Vault Unit is another outstanding example of this organization's efforts to better your service—to bring about greater operating economy and to effect most satisfactory customer relations.

It is a double throw oil switch having on and off positions for either feed. It is operated by the house electrician thru remote manual or electrical control. In addition it is equipped with by-passes through which load may be carried on either feed with every part of the oil switch dead. These by-pass connections can also serve as a tie between the two feeds, the tie and the load feeding through or by-passing the oil switch as desired.

There are also two additional sets of disconnects on the load side of the vault unit. Thus it accommodates two separate transformer banks or one important bank and one primary main supplying a number of services which are also important. The house electrician at the "important bank" will be available to operate the unit. Two separate branches of a primary main supplying important services could also be controlled in the same manner.

Installation time is considerably reduced. The unit is not dismantled for installation of feed and load cables.

It is a space saver. Two potheads, an oil switch, air-break by-pass disconnects and two sets of load disconnects are all combined in one compact unit. It is placed in line with the transformers, effecting further space economy and economy of supporting and wiring materials.

This Unit now is being successfully used by power companies for many of their important loads.

Equipped with the G & W Automatic Master Control and combined with good engineering, it permits a low outage factor at half net work cost.

Investigate the possibilities of this unit now.

ARRANGED FOR EITHER AUTOMATIC OR REMOTE MANUAL CONTROL

G & W designs and manufactures practically every device for the end of a cable. See our Catalog.

Potheads
Series Cutouts
Primary Cutouts
Oil Fuse Cutouts
Undergound Boxes
Conduit Bells
Ground Pipe Caps
Ground Pipe Points
"Oil and air break" disconnecting devices, with and without automatic control.

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G&W ELECTRIC SPECIALTIES

Exactly what you want

More than Protection

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POTHEADS AND BOXES

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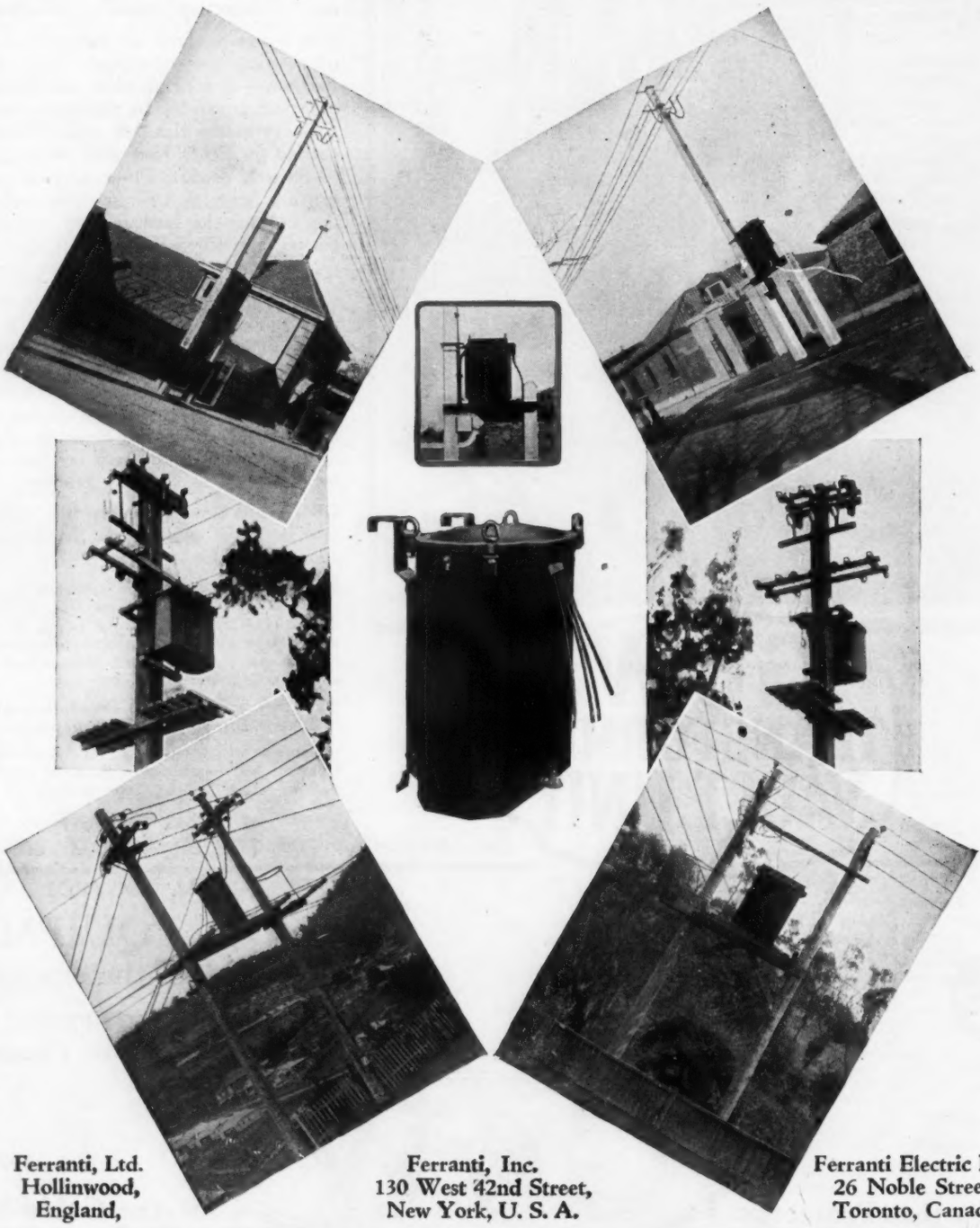
TRANSFORMERS



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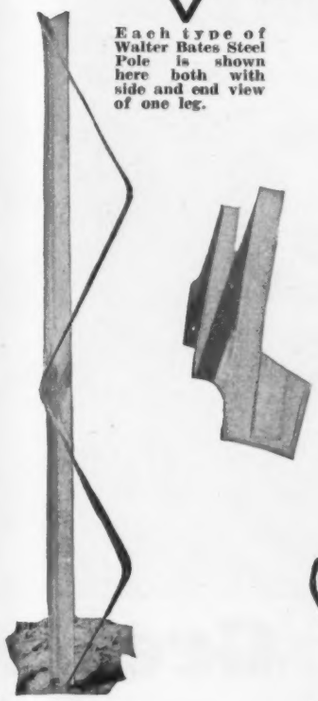
Greatest Strength for every line need

PAGE 7

TYPE 1

Each type of Walter Bates Steel Pole is shown here both with side and end view of one leg.



The big four of the electrical industry—Walter Bates four types of steel poles. Square construction with balanced strength. The type you need is here. Investigate the advantages. Our Engineers are ready to cooperate with you.

TYPE 3

Poles can be furnished without splices in lengths up to 45 ft.

Steel

TOWERS
POLES
SUB-STATIONS
FLOOR—GRATING

and other Steel products for Utilities

TYPE 2

The edge portion of each leg is shear shaped to form lacing member of one face of the pole.

TYPE 4

Can be used most economically in city or open country installations.

WALTER BATES STEEL CORPORATION

GARY INDIANA.

CLEVELAND, O.
E. S. Stickle Company
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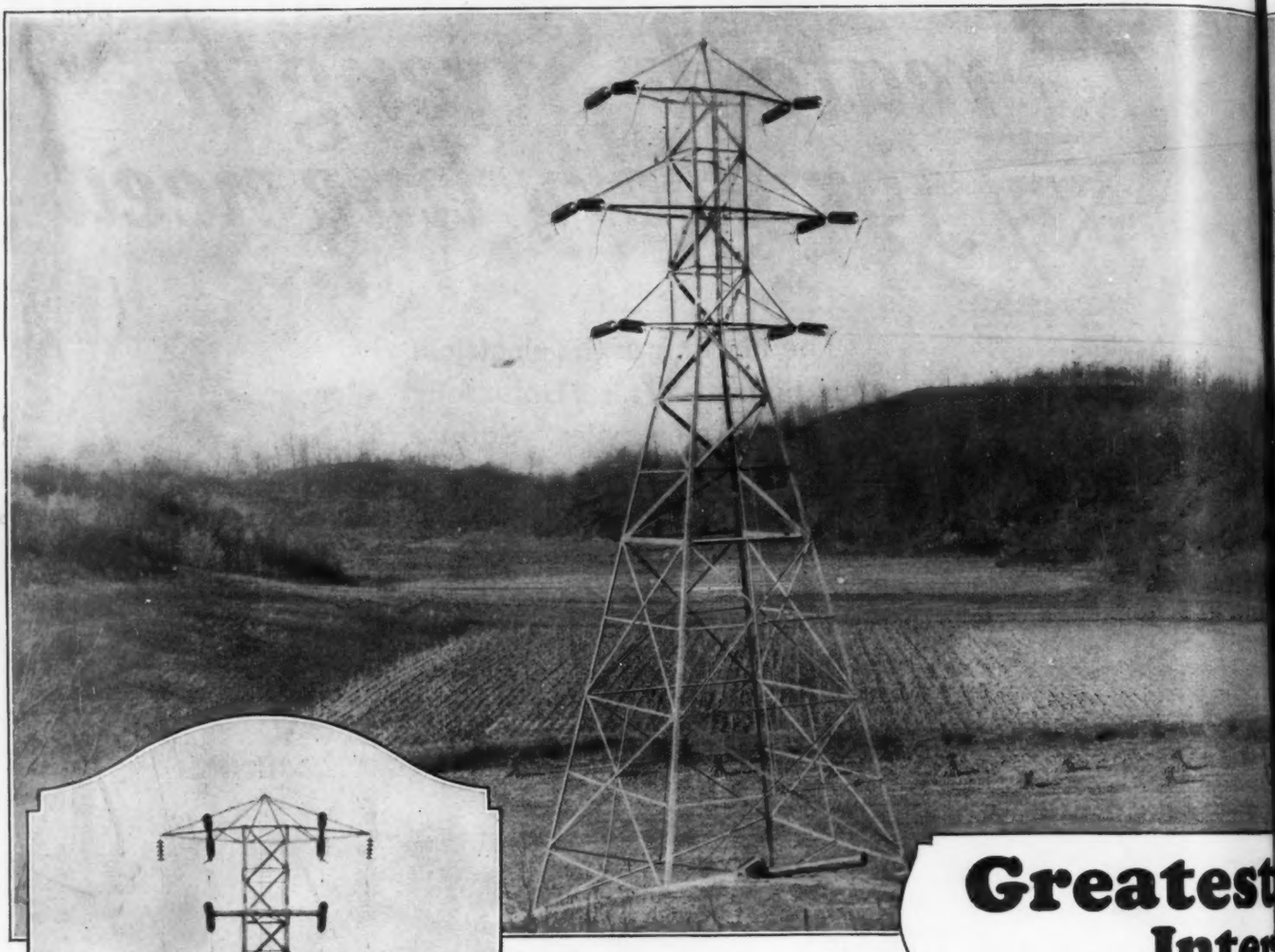
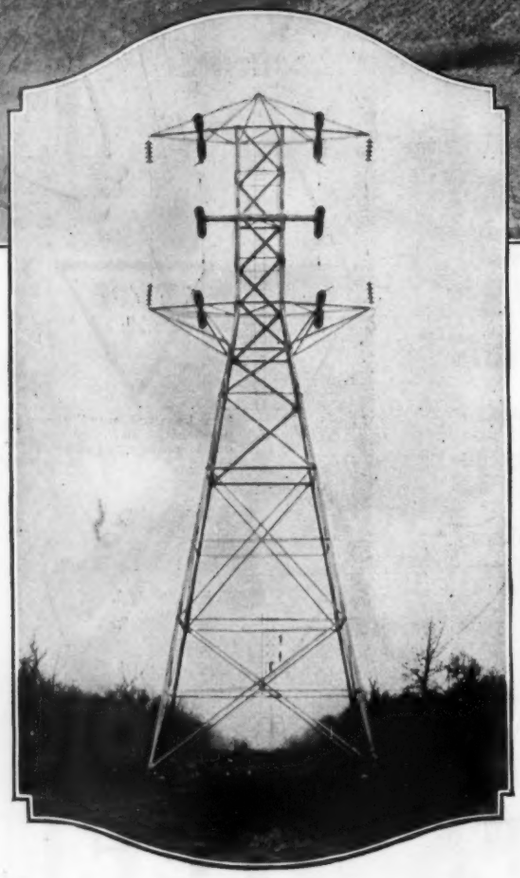
Wonham Bates & Goode Trading Corp.
44 Whitehall St., New York City.

BUFFALO, N. Y.
E. S. Stickle Company
40 West Seneca St.

DALLAS, TEXAS
Jack Milburn
908 Allen Bldg.

BIRMINGHAM, ALA.
Shook & Fletcher Supply Co., Inc.
827 Brown-Marx Bldg.





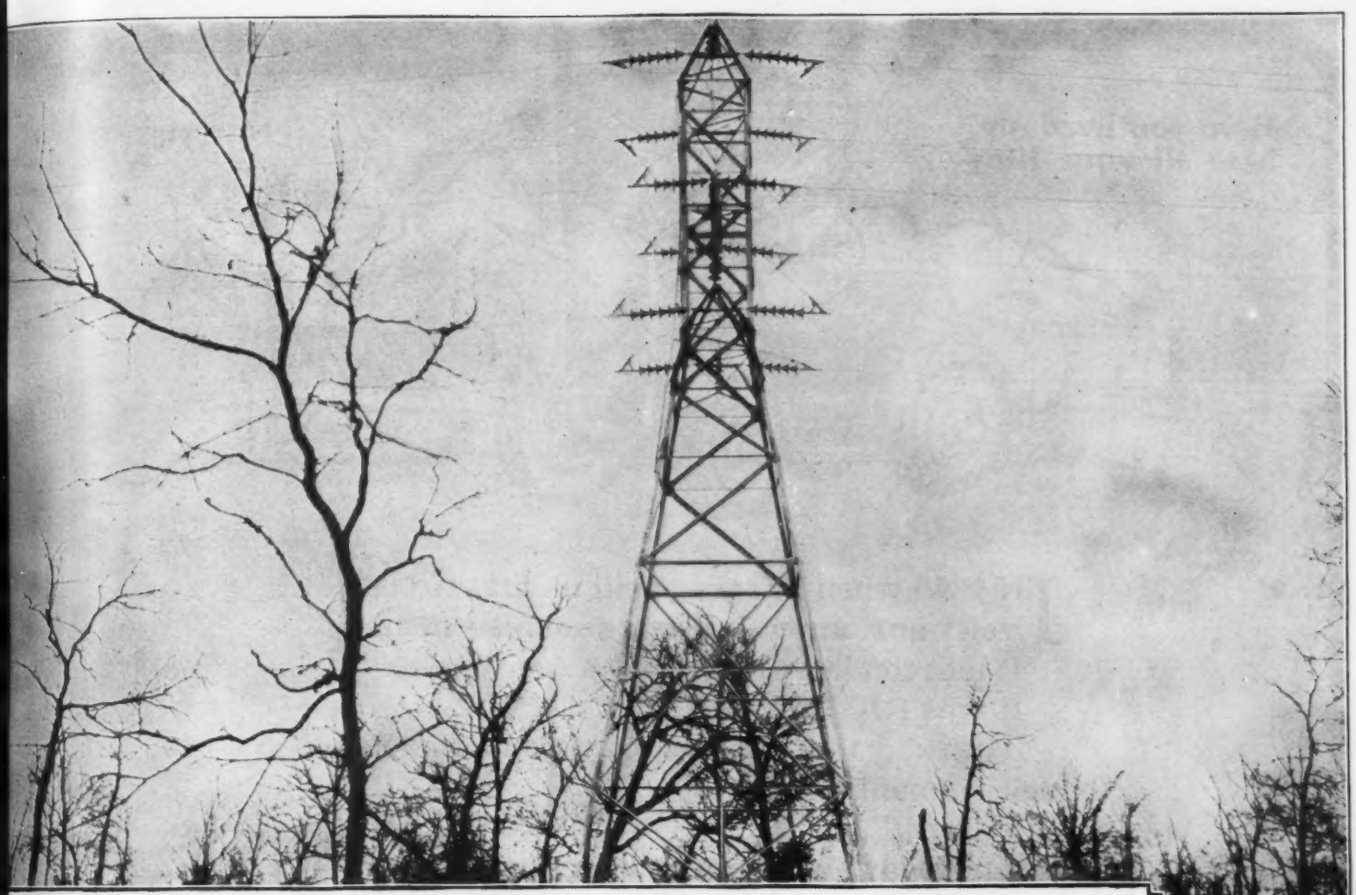
Greatest N
Inter c

Illustrations are of the recently constructed West Frankfort Grand Tower Station 66-kv. line in Southern Illinois. O-B suspension insulators, 25620 and 26240, and hardware used throughout.

HISTORY TELLS

WHICH

LINE EXCELS



Network of 33-kv. Lines connected by 66-kv. Trunk Lines

THE Central Illinois Public Service Company supplies energy to two separate, thickly settled areas of Illinois—a band across the center, and the extreme southern portion of the state, by means of a comprehensive system of power lines. It is said to have the largest network of 33-kv. lines in use.

The reason is simple. The company serves customers continuously throughout the length of its lines and a substation is required for about each five miles of transmission line.

These loads are growing to an extent, however, that 66-kv. trunk lines are being constructed, of which the West Frankfort Line, here illustrated is one, to interconnect the lower voltage systems, enabling interchange of energy to meet load demands most economically.

The distribution situation existing on this property is representative of that existing throughout Illinois, where 1300 communities are served by about 8000 miles of transmission lines.

The Central Illinois Public Service Company maintains interconnection facilities with other power systems at Keokuk, Ia., Vincennes, Ind., Kentland, Ind. and Morganfield, Ky.

Many thousands of O-B No. 11623, two-piece pin type insulators have been used on 33-kv. construction and 25620 suspension units on 66-kv. lines. Here again is an instance of that consistently good record of long service life and negligible depreciation enjoyed by users of O-B insulators everywhere.

Ohio Brass Company, Mansfield, Ohio
Dominion Insulator & Mfg. Co., Limited
Niagara Falls, Canada
361H

Ohio Brass Co.

PORCELAIN INSULATORS
LINE MATERIALS
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VALVES

SALES OFFICES: NEW YORK CHICAGO PHILADELPHIA PITTSBURGH CLEVELAND SAN FRANCISCO LOS ANGELES

IN 1896 when Wagner built its first 10,000 volt transformer . . . it was an achievement.

It met conditions exactly.

It was RIGHT.

Then did the Wagner organization stop development?

"Not yit".

And today 31 years later when the Wagner line of power and distribution transformers is hailed as the peak of transformer progress . . . has development stopped?

"Not yit".

As long as electrical development as a whole continues . . . Wagner development will keep step.

Type HE, 50 Kva. 44,000/22,000 volts to 2400/600 volts, 60 cycles, single-phase, boiler iron case, oil-immersed, self-cooled transformer.

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6400 Plymouth Avenue, St. Louis, U. S. A.

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Always associated with the best

Quality
is built into
HABIRSHAW CABLE

Habirshaw success began and continues in the making of good wire. It has grown with the electrical industry, not only meeting its needs with quality wire, but contributing to its standards and progress. Upon the sound foundation of a "quality first" policy an engineering and manufacturing organization, known for its dependability, has been built.

In a multiple conductor paper insulated cable the fillers are composed of strands of paper which are liable to be of unusual length, the slacker ones doubling over and getting between conductors, forming pockets.

Habirshaw construction keeps all of the strands of filler equally taut, as they assemble in the cable, thus ensuring smoothness and uniformity.

It is painstaking care in the selection of materials and in each step of manufacture that has created for Habirshaw Cable the confidence of the electrical industry.

HABIRSHAW CABLE AND WIRE CORPORATION

10 East 43rd Street, New York City. Plants: Yonkers, N. Y.—Bridgeport, Conn.—Nepperhan, N. Y.

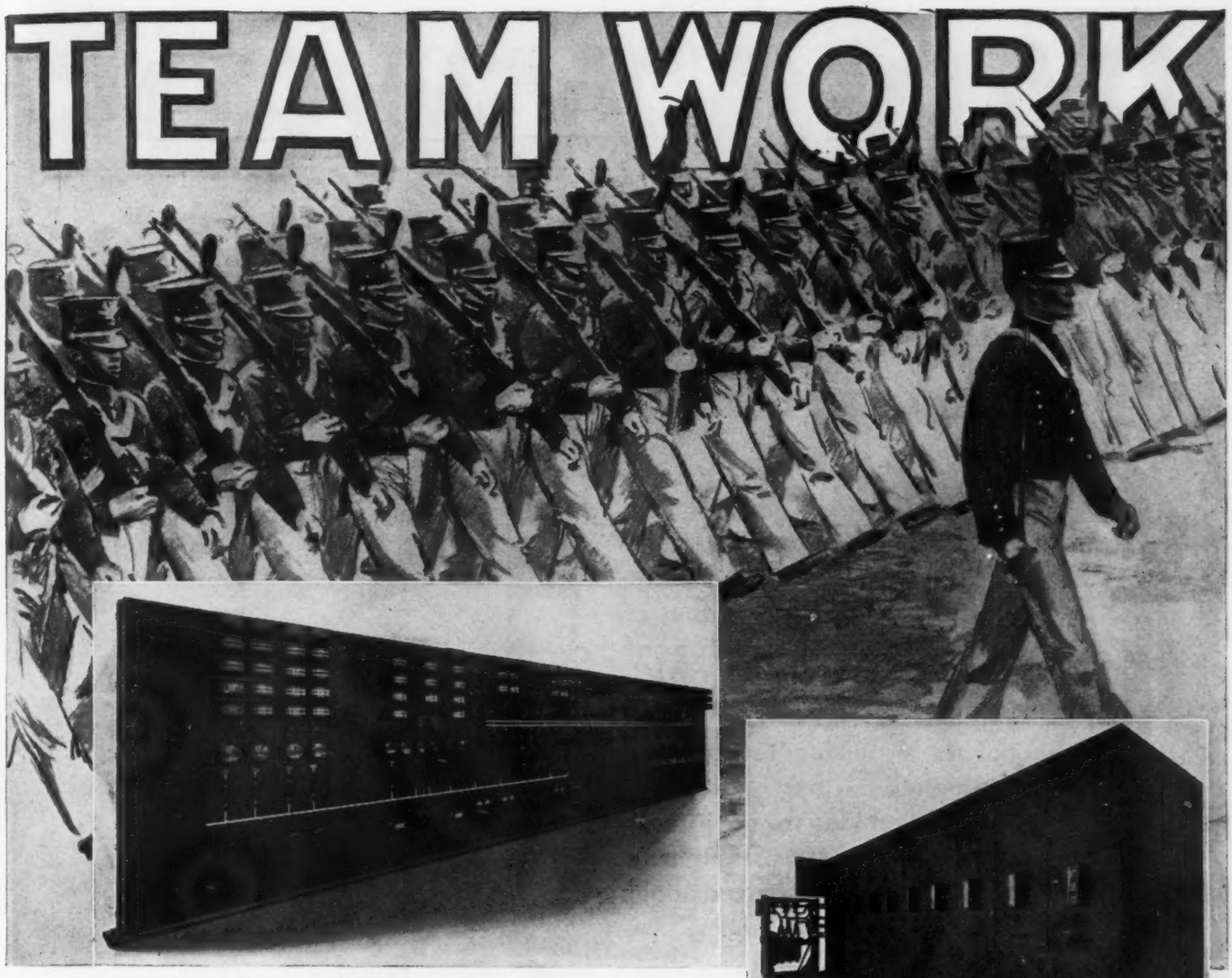
HABIRSHAW

PROVED BY THE TEST OF TIME

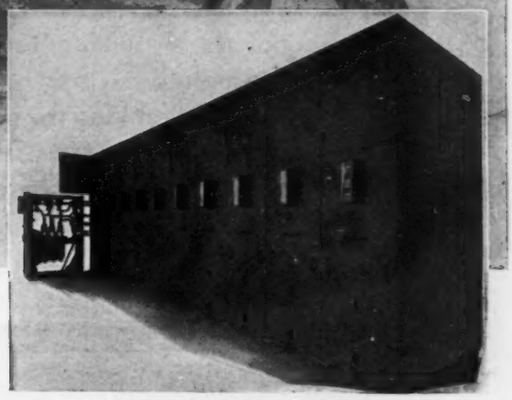
Paper Insulated Cable—Varnished Cambric Insulated Cable—Armored Cable—Rubber Insulated Cable

LONG SPANS
Reduce Costs Safely
with
Creosoted Pine Poles
THE DURABILITY of Creosoted Pine Poles is a fact beyond dispute. Not only is Southern Yellow Pine 44% stronger than the nearest other pole specie — but the variation in strength of individual poles from the average is also much less.
This great uniform strength, made permanent by creosoting, accounts for the standard practice of using smaller poles or fewer poles per mile in Creosoted Pine line construction than when other pole woods are used. The use of smaller poles or longer spans reduces the first cost for poles and lessens labor and hardware costs.
It is perfectly sound engineering to space the stronger Creosoted Pine Poles further apart without sacrificing strength and safety of the line. Are you taking advantage of this opportunity?
The illustration shows International Creosoted Pine Poles at one end of a 4250-ft. span in service of the telegraph division of the Sinclair Pipe Line Co.
International Creosoting & Construction Co.
General Offices: Galveston, Texas
Plants: Texarkana—Beaumont—Galveston
2IC7
The International Dating Nail
International
Creosoted Yellow Pine Poles

TEAM WORK



Left!—Left!—with machine-like precision every foot and arm swings forward as one. Imagine the effect that one man out of step would have on that perfect line of march! But it never happens. Each individual does his part exactly right.



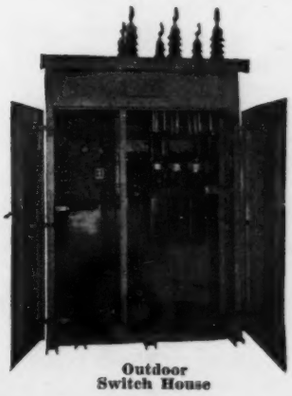
Safety Enclosed Switchboard, Removable Truck Type

The same sort of teamwork from engineer to inspector must be developed to build switchboards that are one hundred per cent right. The Condit organization possesses the facilities to design and build the type and size of switchboards that will meet your exact requirements and the teamwork to make them as near perfection as humanly possible.

CONDIT ELECTRICAL MFG. CORPORATION
Manufacturers of Electrical Protective Devices
Boston, Mass.

Northern Electric Company
LIMITED
Sole Distributor for the Dominion of Canada

For safety enclosed switchboards — removable truck type—benchboards, electrical and manual controlled switchboards, get in touch with Condit.



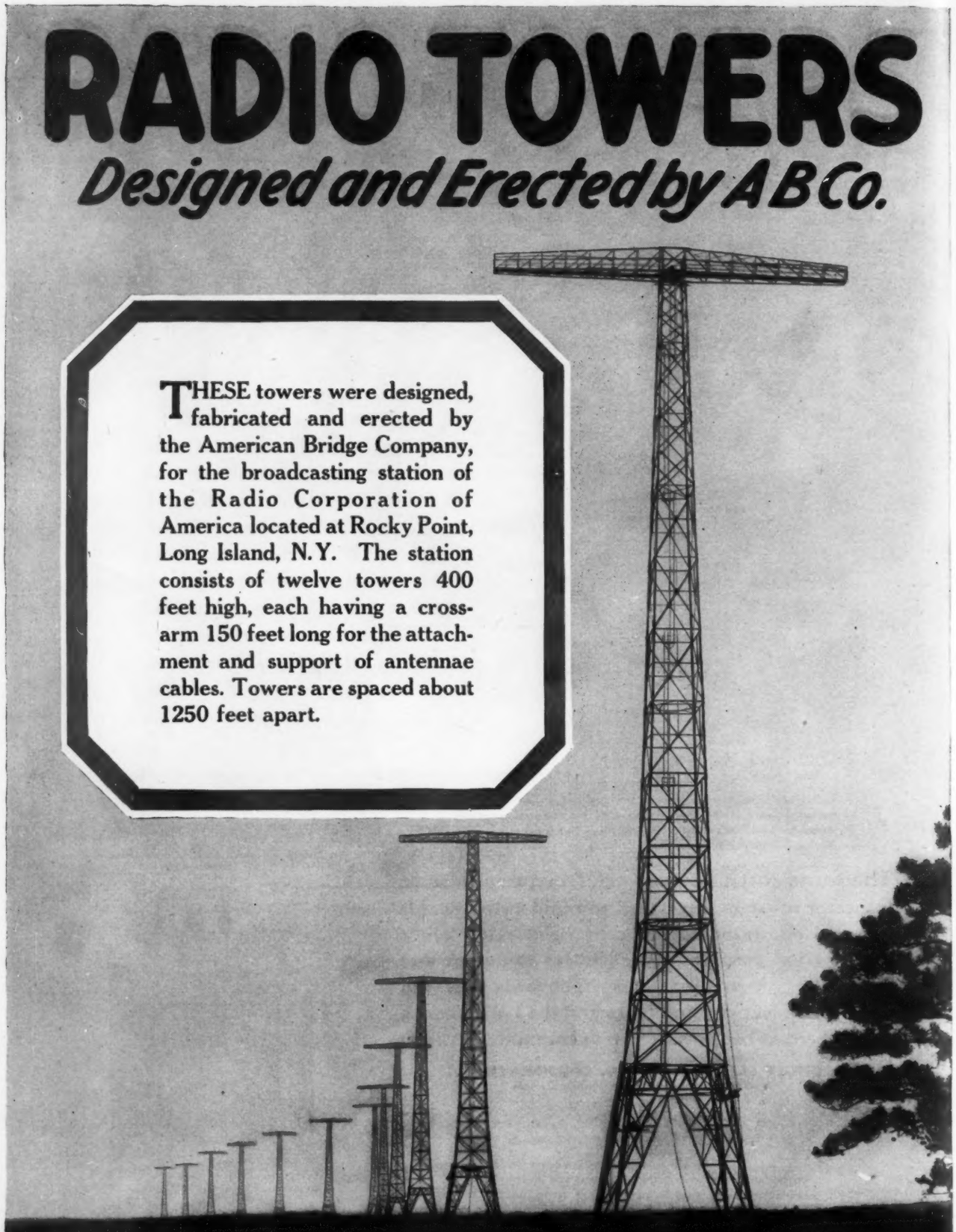
Outdoor Switch House

75

CONDIT

RADIO TOWERS

Designed and Erected by A B Co.



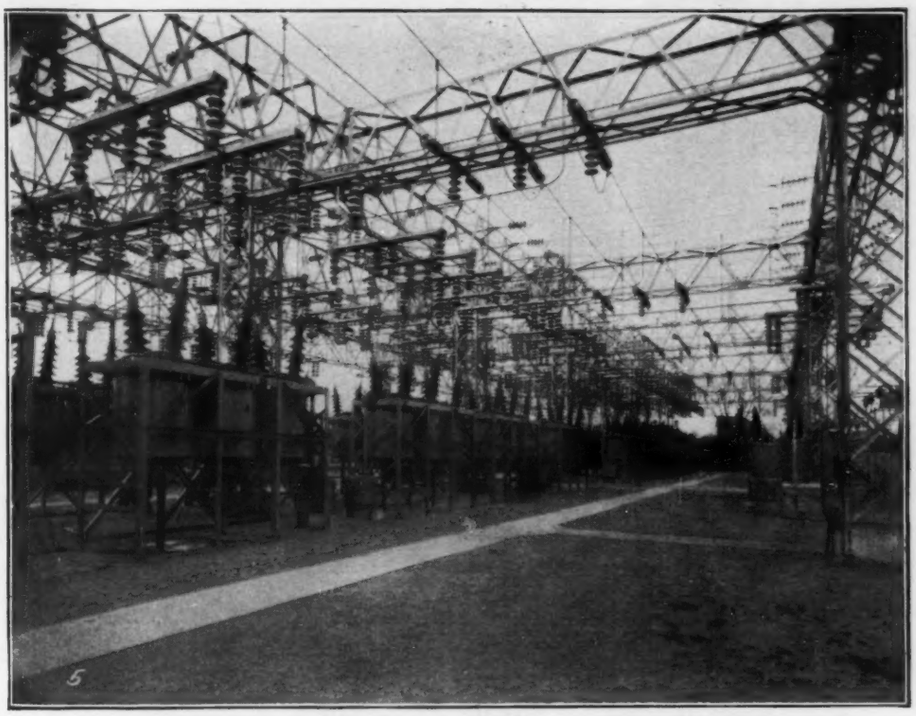
THESE towers were designed, fabricated and erected by the American Bridge Company, for the broadcasting station of the Radio Corporation of America located at Rocky Point, Long Island, N.Y. The station consists of twelve towers 400 feet high, each having a cross-arm 150 feet long for the attachment and support of antennae cables. Towers are spaced about 1250 feet apart.

AMERICAN BRIDGE COMPANY

71 BROADWAY, NEW YORK CITY

TOWER DEPT., FRICK BLDG., PITTSBURGH, PA.

DOUBLE SERVICE



SINGLE RESPONSIBILITY

COMPLETE responsibility for the switch yard of the substation here shown was assured by installing only Champion Switch Company equipment overhead wholly mounted on Jeffery-Dewitt, thick, cementless insulators. Take advantage of this result-getting combination—switch builders and insulator manufacturers under one management, working with a single purpose, to serve better. No alibis, no buck passing under this arrangement. You save first cost, time, worry and long time cost. Pass the buck to us and we'll never pass it back to you. Ask our customers.

The Champion Switch Compa ny
The Jeffery-Dewitt Insulator Company
Kenova, W. Va., U. S. A.

DISTRICT OFFICES

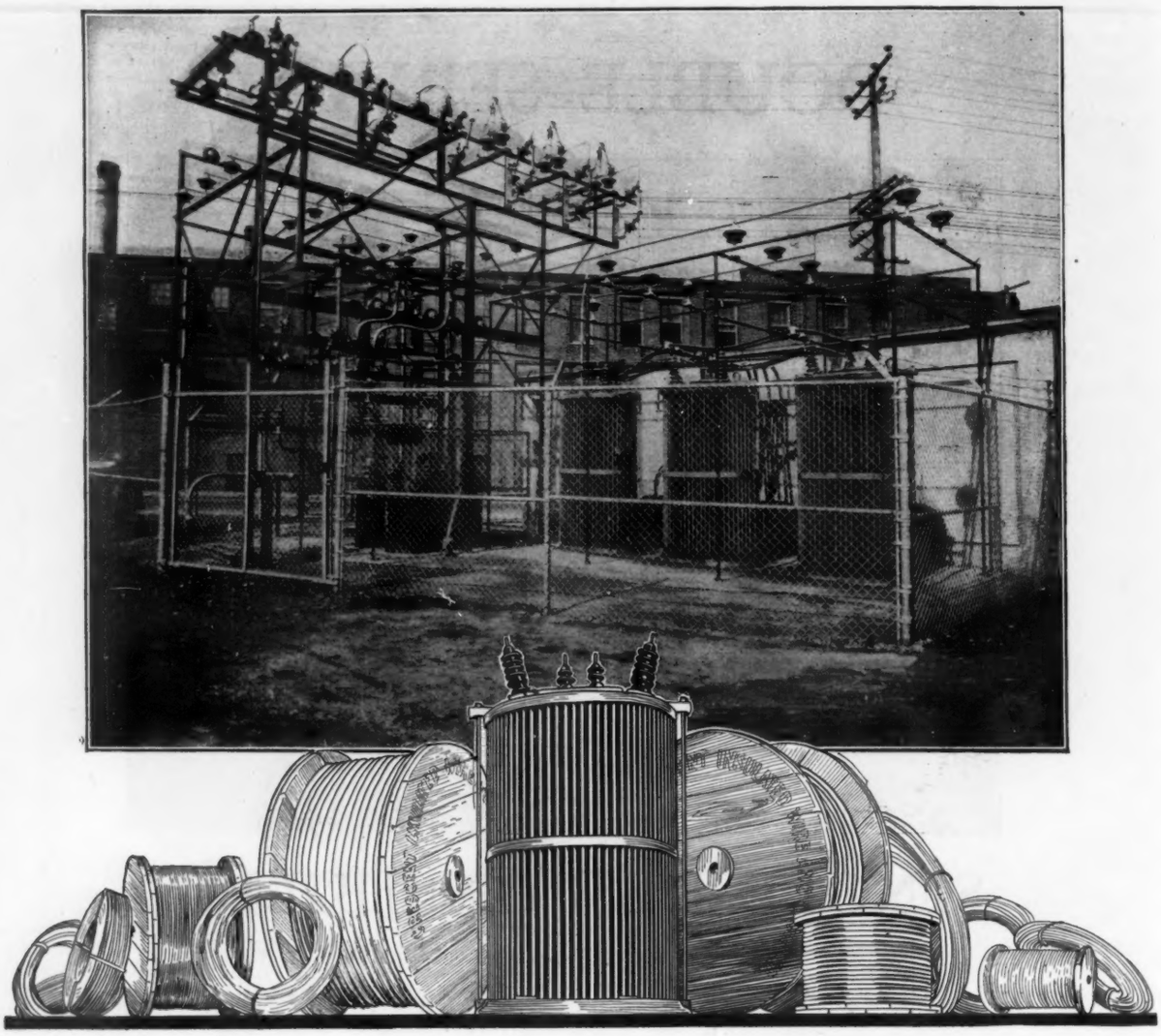
Jeffery-Dewitt Insulator Co., No. 2 Rector Street, New York City.
Jeffery-Dewitt Insulator Co. 550 Abbott Rd., Buffalo, N. Y.
Jeffery-Dewitt Insulator Co., Glen Building, Atlanta, Georgia.
Jeffery-Dewitt Insulator Co., 924 Marquette Bldg., Chicago, Ill.
Jeffery-Dewitt Insulator Co., Cincinnati, Ohio.
Jeffery-Dewitt Insulator Co., Factory, Kenova, W. Va.
Jeffery-Dewitt Insulator Co., 735 Statler Bldg., Boston, Mass.

FOREIGN AGENTS

Lee & Giles, Sydney, Australia.
Richardson McCabe and Cabe, Ltd., Wellington, New Zealand.
T. W. McKay, Electric Ry. Chambers, Winnipeg, Canada.

AGENCIES

Garland-Affolter Engineering Co., Rialto Bldg., San Francisco, Calif.
Garland-Affolter Engineering Co., I. W. Hellman, Los Angeles, Calif.
Garland-Affolter Engineering Co., Alaska Bldg., Seattle, Wash.
Fobes Supply Co., Spokane, Washington.
A. H. Savage & Co., Pioneer Building, St. Paul, Minn.
R. D. Cope, Santa Fe Building, Dallas, Texas.
D. L. Hearn & Co., Langen Taylor Building, St. Louis, Mo.
L. Brandenburger, Salt Lake City, Utah.
A. F. Krippner, Denver, Colorado.
Bishop Sales, Corp., Keefer Bldg., Montreal, Canada.



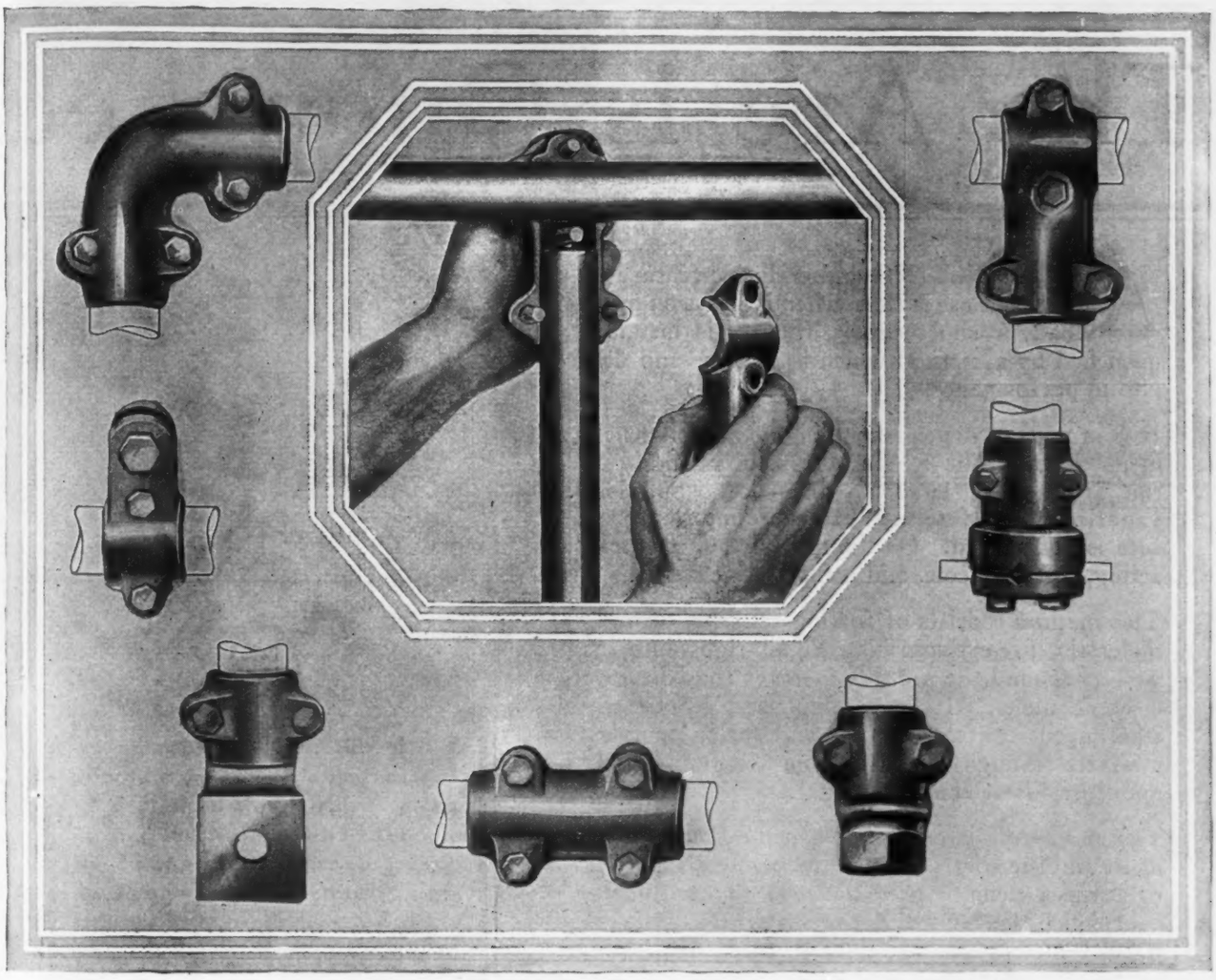
Packards Serve Crescent

The Crescent Insulated Wire & Cable Company at Trenton, New Jersey, demonstrate their faith in the "honest value" of Packard Transformers.

This is one of many precautions they have taken to insure uninterrupted production.

The Packard Electric Company-Warren, Ohio

Packard
TRADE MARK
is never seen, except on goods of honest value



Clamp your outdoor-station buses — *don't* cut, fit, and solder

Outdoor Station Equipment
—part of the complete line of General Electric equipment to control and protect power-generating and distributing apparatus.

These clamp connectors make easy work of installing outdoor-station bus structures. With them you can make any tubular bus connection by a simple clamping operation. In addition to the standard connectors, a wide range of special fittings is available.

The clamps are made of copper alloy for I.P.S. copper tubing or galvanized iron pipe. Four to eight hot-dip galvanized bolts, depending on the size of the clamp, insure good contact, correct alignment, and rigid construction.

Let us send you a descriptive sheet giving sizes and dimensions of the complete line. Just ask our nearest sales office for a copy of GEA-286A.

500-13

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

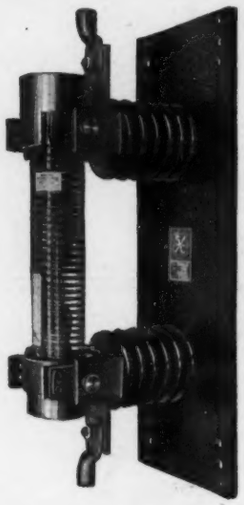
The Arc is Quenched

AN INTERESTING and exclusive feature of the S&C Fuse is that, when it blows on overload or short circuit, the arc is instantly quenched by a method which is positive and definite in performance.

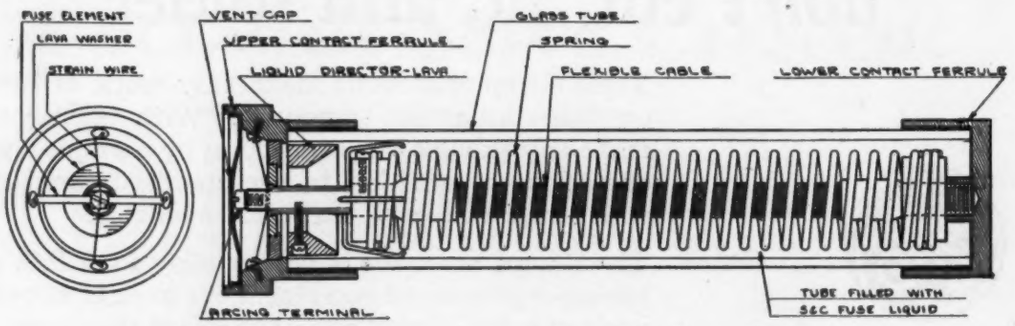
It is in no way dependent upon outside influences in its action. The temperature and humidity of the atmosphere have no influence. Sufficient vaporization of fuse metal to cause internal pressure is not needed. On the other hand, it is self-acting, instantaneous and completely effective.

This method consists of forcing a *stream* of high-dielectric, fire-extinguishing liquid right into, as well as around the arc, the moment that the fuse element melts. It is accomplished by the instantaneous contracting of a coil spring carrying a nozzle through which the liquid is shot directly upon the fuse element terminals.

The coil spring is released when the fuse element melts and the contracting of the spring also serves to form a definite gap, between the terminals, over which the arc will not reestablish.



IT is this rapid and definite extinction of the arc by a positive acting method which helps to make the S&C Fuse the reliable circuit-opening device it is known to be. It is this dependability in performance which has won the recognition that *"there is no substitute for the* S&C *Fuse."*



Showing the Construction of the S&C *Type D Fuse*

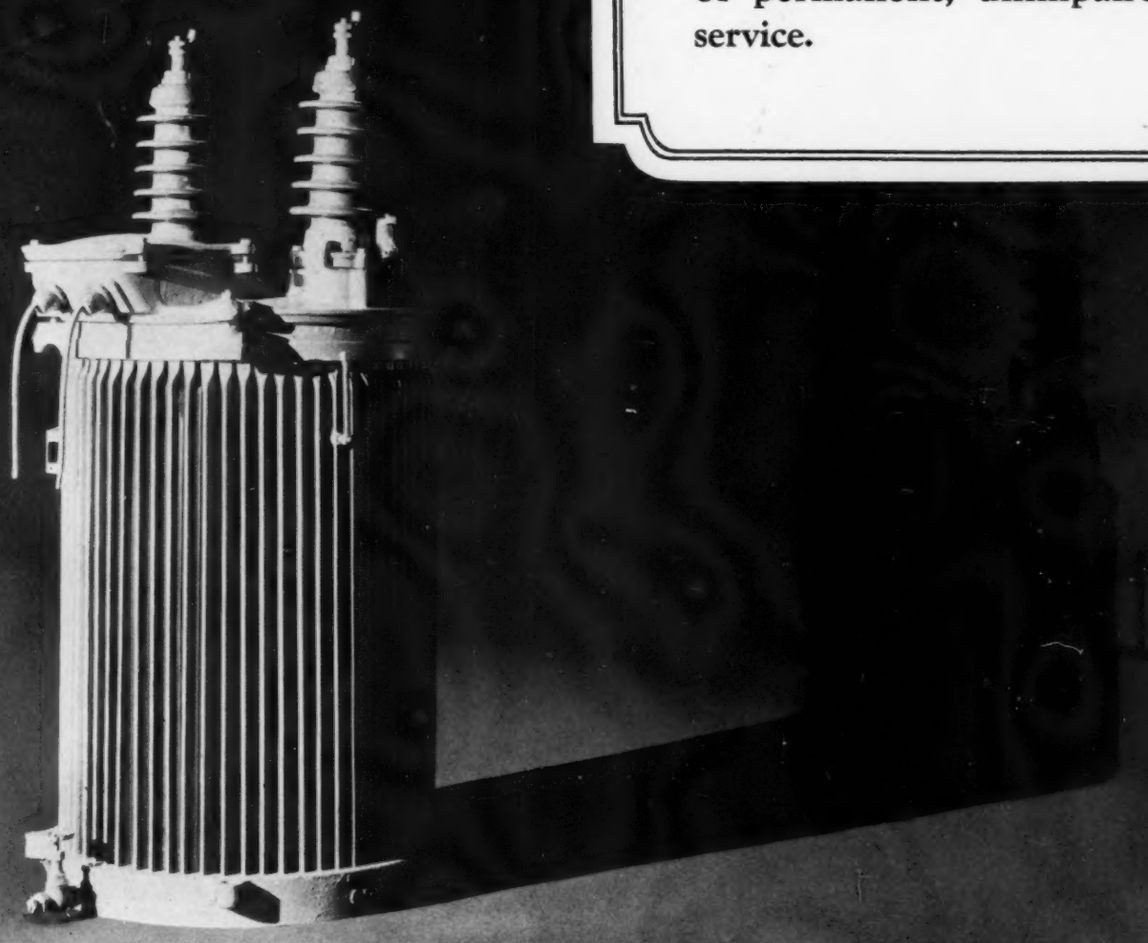
SCHWEITZER S&C CONRAD, INC.

4435 RAVENSWOOD AVENUE CHICAGO, ILLINOIS U.S.A.

New York, Boston, Philadelphia, Buffalo, Pittsburgh, Birmingham, Cleveland, Detroit, St. Louis, Minneapolis, Kansas City, Omaha, Dallas, Seattle, Los Angeles, San Francisco

Japan, T. Hasegawa Co., Osaka

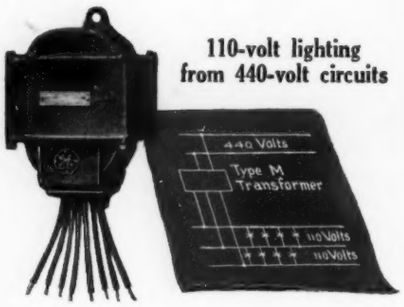
IT IS the personal concern of those who build the type-H Transformer that its admitted position as the Standard of Quality shall be maintained. This signal distinction is due to principles of design found only in type-H transformers, and to ideals of manufacture that give continued assurance of permanent, unimpaired service.



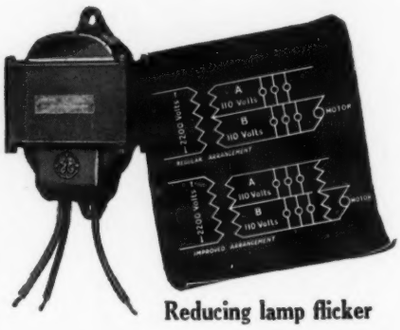
Type-H—the Standard of Quality

401-9

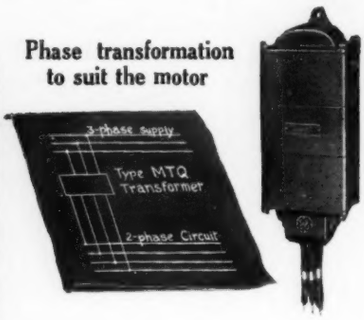
GENERAL ELECTRIC



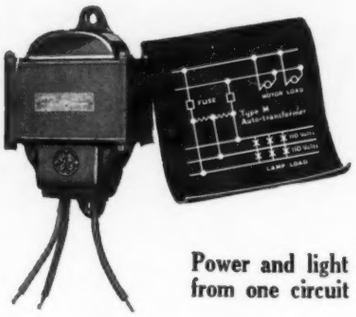
110-volt lighting
from 440-volt circuits



Reducing lamp flicker



Phase transformation
to suit the motor



Power and light
from one circuit

Weatherproof Reliable Quiet

Type M Transformers enjoy a well-deserved popularity. They embody the principles established in the manufacture of transformers for every class of service. The quality built into them is consistent with the high standards which have been set by G-E Transformers for nearly a generation.

Specials, built from standardized parts, can readily be furnished.

Description, standard ratings, and prices in Bulletin 65105.

Type-M Transformers are a part of that well-known line of G-E Transformer Products, a line so comprehensive that it affords power consumers a means of obtaining the proper alternating-current supply to suit any requirement; and it offers to power companies a solution of any transmission or distribution problem.

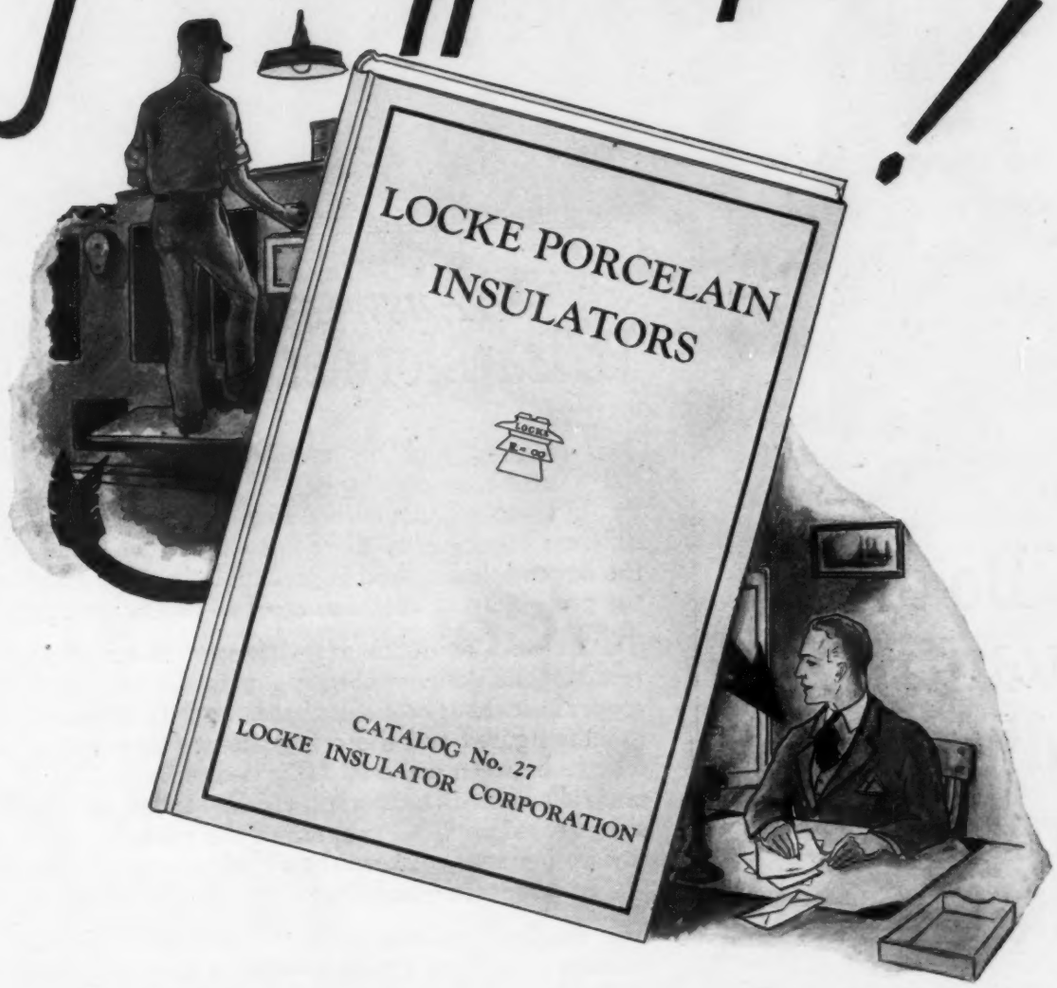
Transformer Products
— the Standards of Quality

405-3

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

Just off the press!



The new Locke Catalog—just off the press—contains over 250 pages of useful information for anyone who is in any way concerned with high voltage transmission.

Since 1894, when Locke produced the first wet process porcelain insulator, Locke Engineers, with every facility for research, have steadily improved both material and design. The results of these years of experience and research are embodied in this new catalog.

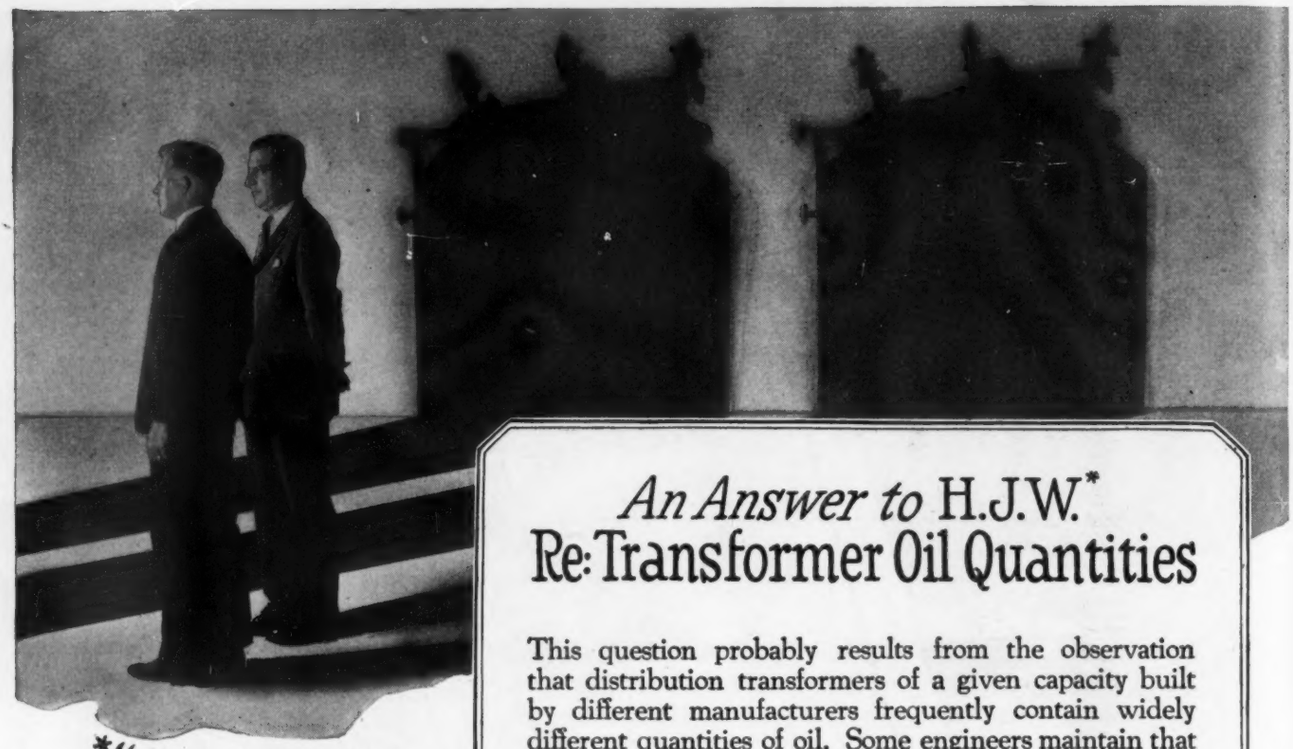
Your name and address on a post card to the Locke Insulator Corporation, Baltimore, Maryland, will bring this valuable book to your desk straight from the press.

LOCKE
R = ∞

LOCKE PORCELAIN

ESTABLISHED 1894

LOCKE QUALITY LOCKE SERVICE



*"Do oil quantities indicate the relative reliability of transformers"?

An Answer to H.J.W.*
Re: Transformer Oil Quantities

This question probably results from the observation that distribution transformers of a given capacity built by different manufacturers frequently contain widely different quantities of oil. Some engineers maintain that the larger volume of oil is preferable because it reduces the probability of overheating—but this is not the fact.

The quantity of oil in a transformer is an incidental result of the design—not a factor in design. After the copper losses have been calculated, the coil surface exposed to oil is figured and the coil gradient (temperature difference between coil and oil) is determined. The maximum allowable oil temperature is the highest coil temperature (based on 55° C. rise) minus the gradient. The case surface necessary to keep the oil below this temperature is then computed—and the volume of oil has been fixed.

The excellent coil ventilation in Kuhlman Transformers permits a very low gradient—that is why oil quantities in Kuhlman Transformers are comparatively small. This smaller oil volume has several important advantages: transformer weight is decreased, and cost of oil filtering and replacement is reduced.

This is one of a series of answers to important questions frequently asked us regarding transformer design, construction and operation.

KUHLMAN TRANSFORMERS

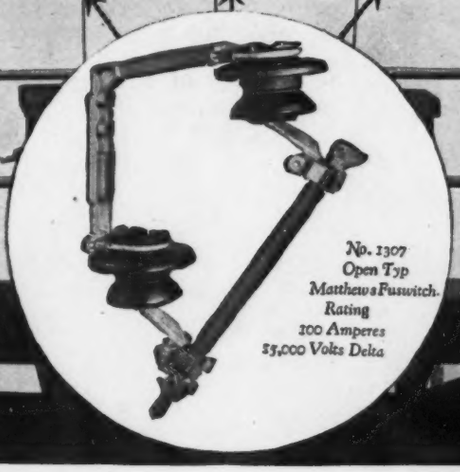
KUHLMAN ELECTRIC CO., Bay City, Michigan

Akron	High and Barges Sts.	Dallas	Unit 2, Santa Fe Bldg.	Minneapolis	1004 Marquette Ave.	Salt Lake City	134 West 2d South St.
Atlanta	411 Glenn Bldg.	Denver	1843 Wazee St.	New York	Graybar Bldg.	San Francisco	Call Bldg.
Boston	69-71 High St.	Detroit	3-260 Gen. Motors Bldg.	Oklahoma City	1013 Braniff Bldg.	Seattle	314 Seneca St.
Buffalo	280 Carolina St.	Greensboro, N. C.	333 S. Davie St.	Omaha	923 W. O. W. Bldg.	Toledo	424 Spitzer Bldg.
Chicago	844 Rush St.	Indianapolis	202 Indiana Ter. Whse.	Philadelphia	1700 Walnut St.	Washington	1328 New York Ave. N. W.
Cincinnati	1308 Union Trust Bldg.	Los Angeles	316 American Bank Bldg.	Pittsburgh	839 Oliver Bldg.		
Cleveland	627 Union Trust Bldg.	Milwaukee	1031 Clybourn St.	Saint Paul	1479 Blair St.	York, Pa.	335 W. Market St.

MATTHEWS FUSWITCHES

and DISCONNECTING SWITCHES

INTERCHANGEABLE



No. 1307 Open Typ Matthews Fuswitch. Rating 200 Amperes 35,000 Volts Delta

Industrial Loads Merit Dependable Fusing

On this industrial connection, three No. 1307 Open Type Matthews Fuswitches are used. This Fuswitch is low in first cost and has high rupturing capacity. Give your customers this low cost dependable protection. Write for 50 page Bulletin 502.

W. N. MATTHEWS CORPORATION

Engineees and Manufacturers

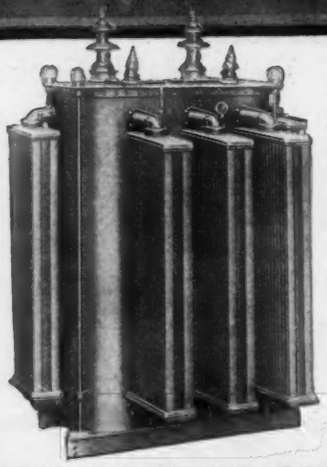
3702 FOREST PARK BOULEVARD - ST. LOUIS, U.S.A.

Offices In All Principal Cities

Your Electrical Distributer Can Supply Them To You

MOLONEY
TRANSFORMERS

Be assured of service and economy specify Moloney Transformers



MOLONEY ELECTRIC COMPANY
Main Office and Factories: ST. LOUIS, MO.
Sales Offices in Principal Cities

ASSURANCE

of complete protection through perfect oil lubrication . . . . .

This is yours when you rely on HYDROIL

BIG ENOUGH to handle the ordinary requirements of the larger stations in regular routine work, the new model F 50 Hydroil will be found valuable in emergency work also, as its capacity —400 gallons per hour—enables it to clean up bad cases of contamination or wetting of oil in very rapid fashion. But speed and capacity are not the only features of the Hydroil that justify your interest in it. The distinctive and exclusive engineering and construction details of the Hydroil machine and the superior service rendered by the Hydroil method are found in this model as in all the machines that preceded it. The utmost reliance can be placed on the Hydroil; moisture and impurities of any degree are removed from insulating oils completely, and the oil restored to a dielectric strength of over 25,000 volts, in one passage through the machine. Can you really ask for more? Do you expect better service than this?

Wherever oil insulated equipment is used, be it transformers, circuit breakers, oil switches, feeder regulators or whatever, there the Hydroil belongs also. Tell us what equipment you are interested in protecting; we will send you particulars of the Machine suitable for the purpose.

Hydroil
SALES CORPORATION
LEBANON, INDIANA

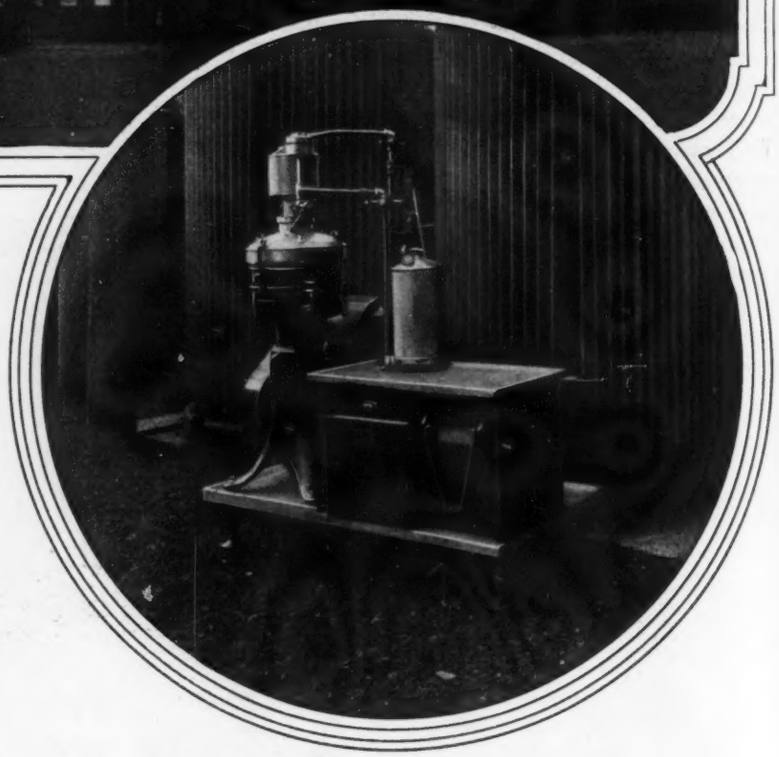
Dry, Air-free Oil

for

conservator type transformers

THE De Laval *Conservator Type* Transformer Oil Purifier restores the dielectric strength of transformer or other insulating oil without aerating the oil. It is, therefore, recommended for use in connection with "conservator" type transformers. These transformers practically eliminate oxidation of oil by keeping it from contact with air while in service. Hence, the value of the De Laval *Conservator Type* Purifier, which keeps the oil from contact with air during the dehydrating process.

Aside from its non-aerating feature, the *Conservator Type* Transformer Oil Purifier is of the same general design and shows the same operating economies as other De Laval Centrifugals which are used by 80% of the largest power companies in America.



De Laval **Conservator Type** Transformer Oil Purifier at a substation of the Metropolitan Edison Company, Hanover, Pa. The Purifier is also equipped with standard covers which enable it to be used to dehydrate oil in non-conservator units.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 600 Jackson Blvd., Chicago

DE LAVAL PACIFIC COMPANY,
61 Beale St., San Francisco

ALFA-LAVAL CO. Ltd.,
34 Grosvenor Road, London, S. W. 1.

De Laval Oil Purifiers

Types for Lubricating Oil, Fuel Oil, Transformer and Circuit Breaker Oil, Crankcase Oil

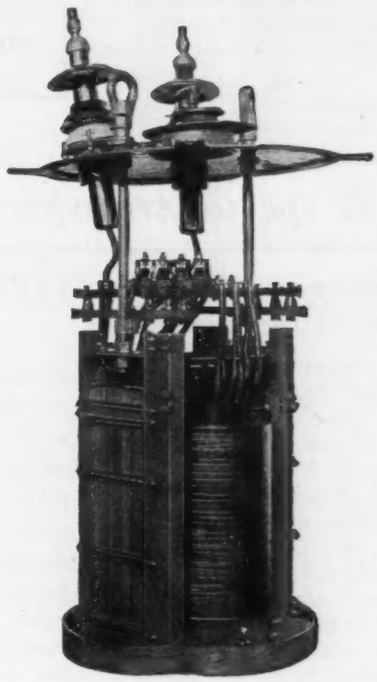
Dynamited by Striking Miners

Tank of 33,000 Volt Transformer
After Explosion
Hole torn in Flutes by Dynamite

DURING a strike recently in the Pennsylvania coal fields, this 200 Kva., 33,000 volt, Pittsburgh Transformer was blown up by striking miners, in an attempt to disable mine apparatus.

Following is an excerpt from the report on this explosion:

> "There is labor trouble in certain sections of Central Pennsylvania coal fields and at * * * * * an attempt was made to blow up with dynamite the substation of three 200 Kva. Pittsburgh Transformers, 33,000 volts.
>
> Explosion occurred at midnight. The substation is on the Lakes to Sea Highway one mile east of * * * * so that in looking for the trouble it was not found until seventeen hours later, at 5 P.M., when children reported oil around the station.
>
> When the operating men arrived, a hole was found in the base of the middle transformer of the bank almost a foot in diameter, all the oil, almost 290 gallons, was out of the transformer, and the transformer had been operating full load for seventeen hours without oil, as this bank of transformers operated mine pumping load.
>
> This certainly speaks well for the transformer under such conditions."



This transformer was tested and found undamaged, even after seventeen hours' operation without oil and at full load.

A new tank was made and new bushings supplied, and the transformer returned to the customer without any repairs being necessary to the vital parts (the core and coils).

Pittsburgh Transformer Company

Largest Manufacturers of Transformers exclusively in the United States

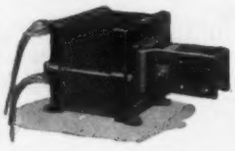
Pittsburgh, Pennsylvania

AMERICAN TRANSFORMER

SMALL AIR-COOLED TRANSFORMERS for phase transformation and special applications

Type CF transformers for low voltage and high current

This transformer can be used for heating, welding, riveting, testing of current transformers, switches, circuit breakers or other similar applications. Sizes up to 10 kva. The secondary of this transformer is made up of bus bar type copper. It has therefore, very high conductivity and provides convenient means of connecting to the secondary circuit. The primary is provided with taps for varying the secondary voltage. Range in the secondary voltage can be about 50% variation. Full details in Bulletin 1040-W.

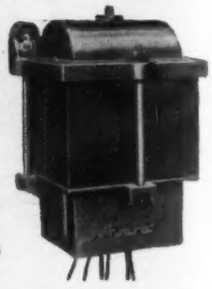


Here are a number of small transformers typical of those described in the new American Transformer Bulletin 1040-W.

These transformers are built for voltages up to 550, in sizes from 10 to 5,000 watts, 60 cycles, and up to 4,000 watts, 25 cycles. Immediate delivery can be made on transformers for 220 volt primary, 110/220 volt secondary, single phase, 60 cycles, in sizes from 1 to 5 kva.

It is probable that the transformers you need are not shown here. However, send us your specifications and we shall be pleased to give you a prompt quotation, also a copy of Bulletin 1040-W.

Two winding CF transformer



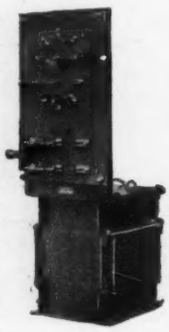
This transformer is of the two winding type, the primary being wound for single - phase 220 volt and the secondary for 110/220 volt. It is built in sizes 1 to 5 kva. and is carried in stock for 220 volt, 60 cycle primary. It can be wound for 440 or 550 volts for reasonably quick delivery.

These transformers can be used indoor or outdoor and are exactly what the distribution superintendent and industrial plant electrical engineer require where the use of auto transformers is forbidden.

Ask us for Bulletin 1040-W.

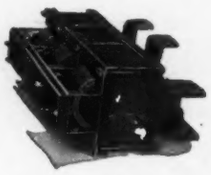
A special transformer for every industrial requirement

A complete control unit for heat-treating furnaces



This resistance type furnace transformer complete with primary switchboard consists of two 5 point knife blade dial switches and one double pole double throw knife blade switch. The transformer is made in sizes up to 30 kva. for intermittent service. The secondary is wound in two equal coils and the primary is wound in two sections, one has coarse taps and the other fine taps. With the combination of these switches it is possible to regulate the secondary voltage to 25% of the maximum in 50 equal steps. Described in Bulletin 1040-W.

Electric heating unit made up of three transformers

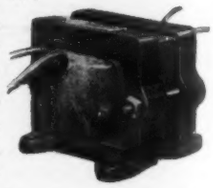


is one of the many applications of American small air-cooled transformers. A recent application of one of these units for that purpose is shown. Three transformers are mounted together in one framework. The primaries are connected delta for operation on a three-phase circuit. Taps which are used for getting a considerable variation in the secondary voltage are brought to a terminal board. This variation can usually be at least 2:1 in. outside limits. Often the range is increased. The secondary is arranged for connecting to a three-phase bus which is built in the form of heating electrodes. This bus is clamped to the terminals shown in the illustration and forms the delta connections.

Write for Bulletin 1040-W.

Type CF for phase transformation

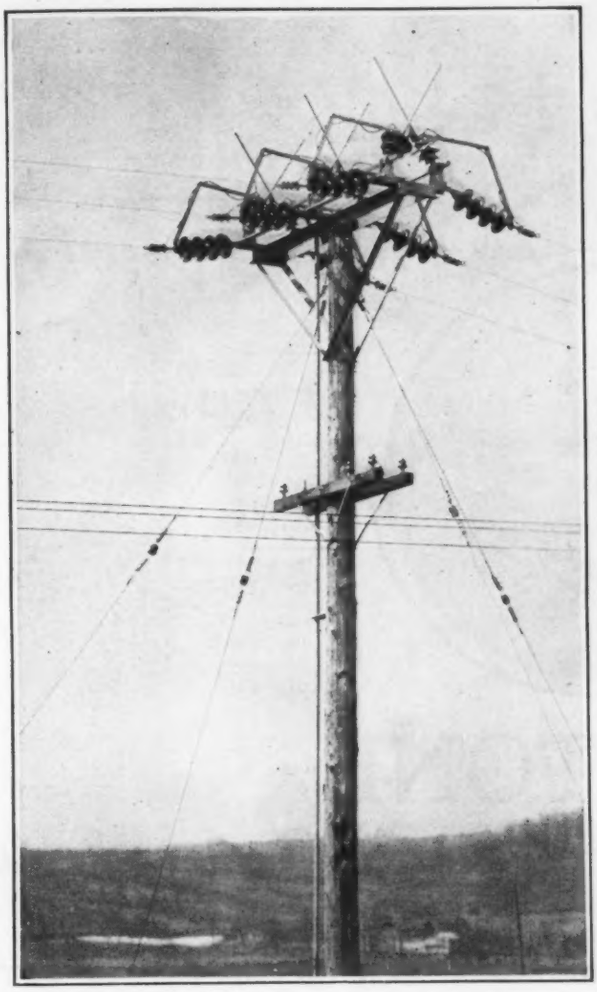
To obtain 2 phase from 3 phase circuits or vice versa so as to operate motors from a given supply circuit, we have developed this phase changing auto-transformer —supplied in two units which are to be interconnected. Described in Bulletin 1040-W.



To supply the demand for small, air cooled transformers for use as an integral part of industrial machines, we have developed type CF transformers with open end frame mountings. Parts carried in stock for making transformers up to 550 volts primary with secondary voltages to suit.

Described in Bulletin 1040-W.

AMERICAN TRANSFORMER COMPANY
178 Emmett St., Newark, N. J.



Snapped from a slow train in N. Y.

Sectionalizing lines with Elpeco Horn Gap Switches seems pretty general.

You see them in this role from the car window as you travel around the country.

Of course it is the *reliable* means—and I snapped this one because it shows an economical installation—on a single pole.

Four guys give the structure absolute rigidity.

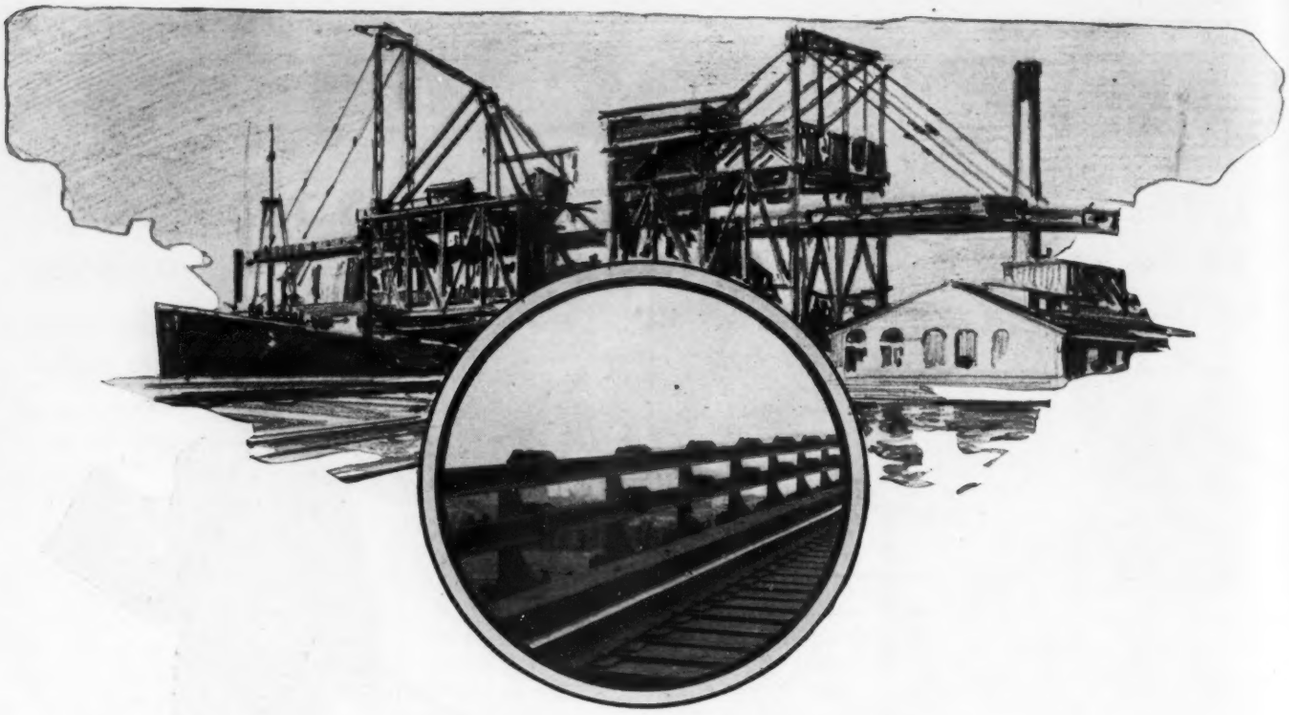
When you get economy and reliability in any single piece of equipment—what more can be asked?

L. P. Cox

ELPECO

ELECTRIC POWER EQUIPMENT CORPORATION

412-420 NORTH EIGHTEENTH ST. PHILADELPHIA, PA.



KEYSTONE

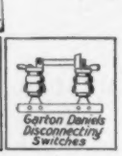
—*for safety and service in contact rail material*

Keystone Contact Rail Material provides the constant contact that insures reliable transmission of power to your cranes, conveyors and other electric industrial hoisting and hauling systems.

Such performance means more tons per day day-in-and-day-out, which can be easily figured out in increased profits.

Let our engineers cooperate with you in the selection and installation of various types to meet your specific requirements.

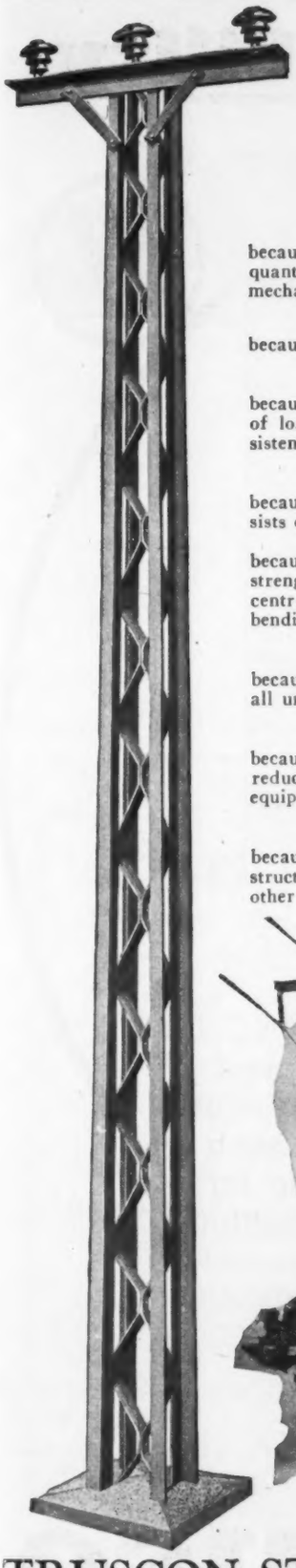
ESSCO Bulletins completely illustrate and describe all types of Keystone Electrical Equipment. Write for particulars of the ones in which you are interested.



ELECTRIC SERVICE SUPPLIES COMPANY
PHILADELPHIA, 17th & Cambria Sts.; NEW YORK, 50 Church St.; CHICAGO, Ill. Merchants Bank Bldg.; Pittsburgh, Bessemer Bldg.; Boston, 88 Broad St.; Detroit, General Motors Bldg.; Scranton, 316 N. Washington Ave.; Canadian Agents, Lyman Tube & Supply Company, Ltd., Montreal, Toronto, Vancouver.

ELECTRIC SERVICE SUPPLIES CO.

MANUFACTURER OF RAILWAY, POWER AND INDUSTRIAL ELECTRICAL MATERIAL



STEEL POLES
for Dependability

Low in First Cost

because through standardization we are able to manufacture them in large quantities from a minimum stock of shapes and with the lowest number of mechanical operations.

Low in Maintenance Cost

because their construction makes for easy inspection, painting and cleaning.

Unequalled in Efficiency

because, built of steel, they make possible mathematically correct calculations of loads and stresses enabling you to select the lightest weight pole, consistent with safety, for any conditions.

Unsurpassed in Permanency

because they are manufactured from Copper-Alloy Steel—the steel that resists corrosion.

Correct in Design

because they are an adaptation of the Warren Truss—a construction, the strength and economy of which is well known. All materials being concentrated at the four corners, these poles offer a maximum resistance to bending, both in the longitudinal and in the transverse direction.

Neat in Appearance

because they are rigid, gracefully slender, nicely tapered and free from all unnecessary lattice work, bolts, braces and other cumbersome parts.

Easily and Cheaply Erected

because while light in weight their great strength permits longer spans thus reducing the number of poles to be set, as well as the cost of insulators, equipment, and pole setting rights.

Extensively Adaptable

because they can be used in single pole construction, in "H"-frame construction, in Sub-Station construction, for carrying pipe lines and for many other purposes.

A Complete Line of Pole Line Hardware and Specialties

Anchor Rods
Carriage Bolts
D. A. Eye Bolts
Eye Bolts
Lag Screws
Machine Bolts
Alley Arm Bolts
Angle Drop Braces
Angle Back Braces
Cross Arm Braces
Vertical Arm Braces
Guy Clamps
Suspension Clamps
Cross Arm Clamps
Hub Pole Guards
Wire Rope Clips
Ground Wire Terminals
Guy Hooks
Ground Rods
Square Nuts
Eye Nuts
Guy Shim Strips
Bolt Eyes
Guy Thimbles
Strain Plates
Protecting Strips
Pole Steps
Turnbuckles
Round Washers
Square Washers
Centering Washers
Stubbing Washers
Saddle Washers
Locking Washers
Telephone Cross Arms
N. E. L. A. Arms
Transmission Arms
Bayonets
Ground Wire Clamps
Forged Bolt Clevis
Flat Steel Clevis
U. Bolts Clevis Eyes
Bolt Type Clevis
Klauber Clevis
Cross Arm Clamp Pins
Screw Type Pins
Bolt Type Pins
Heavy Duty Pins
Western Union Pins
Secondary Racks
Telephone Pole Brackets
Lighting Mast Arms

Truscon Steel Poles used in "H" Frame Construction

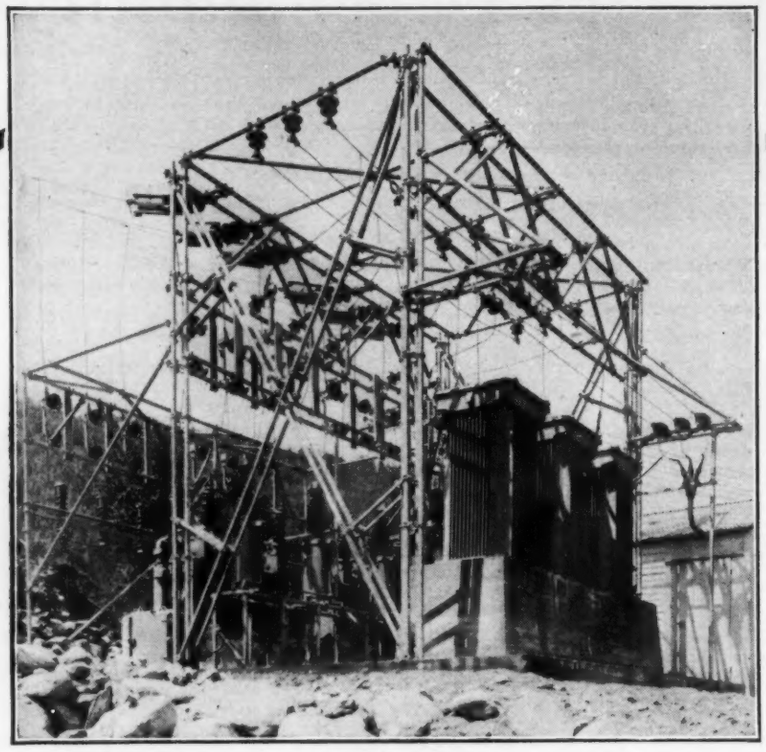
Illustrated catalog free on request

TRUSCON STEEL COMPANY, YOUNGSTOWN, OHIO

Established 1903

FOREIGN TRADE DEPARTMENT, 90 WEST STREET, NEW YORK CITY
TRUSSED CONCRETE STEEL COMPANY OF CANADA, LIMITED, WALKERVILLE, ONT.
Warehouses and Offices in All Principal Cities

Undivided Responsibility



A 750 Kva. 33,000/2300-Volt Pipe-Frame Outdoor Substation. These towers are easily erected, without previous experience or special tools.

THE Westinghouse Electric Company builds, with undivided responsibility, moderate and high capacity outdoor substations of either pipe frame or structural steel construction, complete with all auxiliaries, such as gang-operated disconnecting switches, lightning arresters, fuses, single-pole disconnecting switches for lightning arresters, high-tension and low-tension bus supports, as well as transformers, oil circuit breakers and metering equipment.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of the United States and Foreign Countries X94070

Westinghouse

X94070

No. 601
Recommended Working Load, 3500 pounds. Rated Combined M. and E. Strength, 10,500 pounds. Reserve Strength Ratio 3:1

Ready for Any Emergency

THE desert rat has learned to be self-sufficient. He carries on his burro all food and supplies necessary for his existence. He has to—miles of arid desert lie between him and fresh supplies.

The desert is now crossed by power lines. Transmission towers with their porcelain insulators stand where the desert rat parks his burro for the night. The distance to supplies has not decreased.

The isolation of many power lines is one very important reason for high-strength porcelain insulators, insulators that will support the copper through the icy blizzards of winter and the storms of summer—and still have plenty of strength in reserve for the emergency no one expects. The reserve strength in Westinghouse insulators saves many a long trip for the emergency crew and preserves continuity of service.

Porcelain
you can install *—and forget*

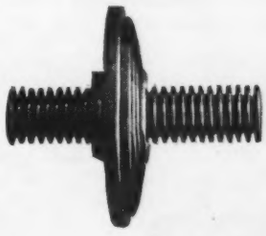
—because science—not tradition—governs the making of all Westinghouse porcelain and insulators.

—precision processes, at every stage, are the rule.

—never is anything taken for granted at any time.

—even slight variations in raw materials are compensated for.

First the design—then the materials—then the method—and then, a vigilance that permits no compromise.



Westinghouse Electric & Manufacturing Company
Derry (Pa.) Works Emeryville (Calif.) Plant
Sales Offices in All Principal Cities of the United States and Foreign Countries

Insulators with Reserve Strength

Westinghouse

X92749

IT IS TIME FOR THE POWER INDUSTRY TO SELL RANGES

HIGH DIVERSITY FACTOR
From The Range Load

" . . . . With a reasonable number (of ranges) installed, a generating station diversity of about 10 to 1 is readily obtained and as high as 12.5 to 1 has been recorded." . . . . . Here's another conclusion from the report of the Domestic Cooking and Water Heating Committee of the N. E. L. A.—another proof that the range load is both profitable and desirable. When the sum of the individual peak demands can be made 10 to 12 times the group peak demand, there is little doubt that it pays to push the sale of ranges until this high diversity factor is reached.

Sell Westinghouse Ranges

Once sold, a Westinghouse range "stays sold". The simplicity and strength of its construction give it an exceptionally long life and keeps service charges to a minimum.

A brief review of Westinghouse features which makes these ranges outstanding will serve to illustrate this point:

Simplicity

The control devices on the Westinghouse Automatic Range consist simply of a clock, a thermostat and a circuit breaker—no sensitive or complicated parts to get out of order easily.

Economical

With the heat control devices used on the Westinghouse Full Automatic, the current is shut off when the proper heating temperature has been reached—no wasted electricity.

Oven Lining

The oven is built with an inner shell of vitreous enameled sheet steel, a finish which is easy to clean and impervious to rust.

Rounded Corners

All corners are rounded. This feature not only adds to the beauty of the range, but is also of practical value, for sharp corners respect neither clothing nor person.

Accessibility of Parts

A sliding panel in the back of the range gives access to wiring and terminals. The surface units are semi-removable and can be taken out easily in a few moments time. The oven units are removable by hand and the oven lining is floating and consequently easy to remove or replace.

Westinghouse Electric & Manufacturing Company
Merchandising Department
Mansfield Works Mansfield, Ohio

Westinghouse

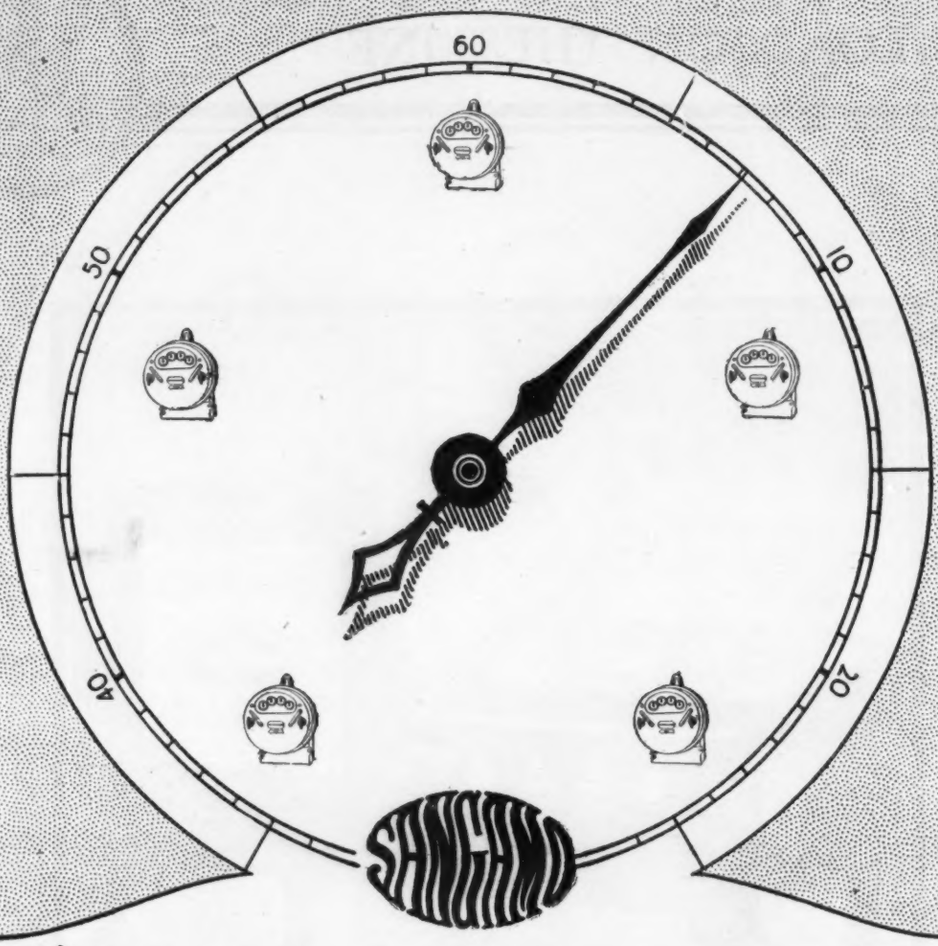
X92799

WESTINGHOUSE RANGES KEEP THE LOAD ON THE LINE

The Console Full Automatic
$122.50

Westinghouse

X92799-A



5 TIMES EVERY MINUTE
a Sangamo Meter is installed

ALMOST as you think about it, another Sangamo Meter is installed—on land—on sea—in the air. 300 Sangamo Meters are connected in circuit every hour of the working day—one every 12 seconds.

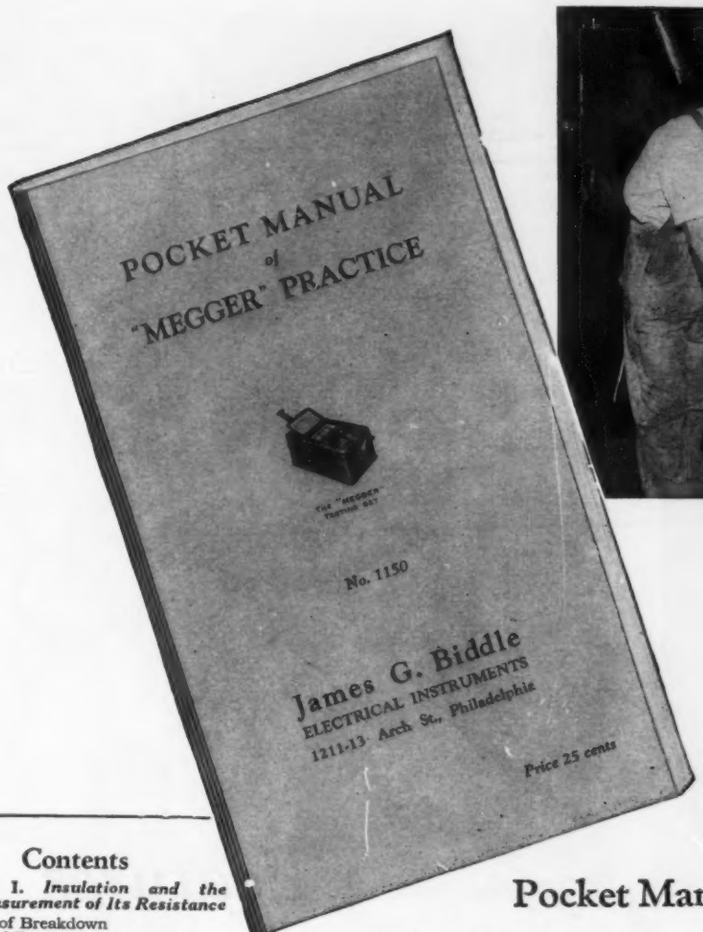
As a result of such insistent demand, you'll find Sangamo Meters controlling and measuring electrical energy all over the world. In factories and homes, they serve year after year, as an accurate standard to maintain the goodwill of electric-power companies toward their customers. On battleships and submarines of the United States and other navies, they fall in step with the precision that is the pride of this branch of the service. In transportation—on electric trucks—mine locomotives—railroad cars—and limited trains, Sangamo Meters guide the energies of these veritable arteries of industry.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

New York Boston Chicago Birmingham
San Francisco Los Angeles

SANGAMO METERS
FOR EVERY ELECTRICAL NEED

8137-6



From the users' viewpoint!

Unbiased opinions about this 80 page Pocket Manual on Insulation Testing

From a large Power Company—

"I am very much pleased with the contents of your manual on 'Meggering'. I believe it is a marvel, insofar as it lacks 'advertising propaganda'; and presents very, very interesting facts on your varied experiences pertaining to insulation testing."

From a Telephone Company—

"Your new 'Manual of Megger Practice' certainly contains a wonderful amount of interesting information on the general subject of insulation testing. The instrument we recently purchased from you is proving very satisfactory in every respect."

From the U. S. Signal Corps—

"Please forward at your convenience the Pocket Manual regarding insulation tests with your most valuable 'Megger'. Any information regarding tests with your instruments will be greatly appreciated."

From a large Electrical Manufacturer—

"Will you kindly send the writer three copies of your Pocket Manual. As you undoubtedly know, this company specializes in the 'Megger' for tests. The writer believes that the 'Megger' is the only sure instrument for generators, motors, and transformers. We have one of your latest 'Super-Meg' Sets."

Doubtless you, too, have insulation testing problems which could be solved by "Megger" Test. We shall be glad to send you—*free of charge*—the Pocket Manual of "Megger" Practice, No. 1150. Write today.

JAMES G. BIDDLE
Electrical Instruments
1215 Arch Street, Philadelphia

Contents

Chapter I. ***Insulation and the Measurement of Its Resistance***
Causes of Breakdown
Effect of Temperature
Drying out Moisture
Systematic Tests

Chapter II. ***Directions for Various Insulation Resistance Tests***
What to Expect

Chapter III. ***Special Directions for "Megger" Testing***
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High-tension Insulators
Telephone Cable and Lines
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Wiring Installations
Electrical Fittings, Condensers, etc.
Switchboards and Panelboards
Radio
General Laboratory Work

Chapter IV. ***Principle of Operation of "Megger" Instruments***

Chapter V. ***General Instructions for Using "Megger" Instruments***

Biddle Specialties

"Megger" Insulation Testing Instruments
Frahm Frequency Meters
Frahm Tachometers
Speed Measuring Instruments
Jagabi Rheostats
Dionic Water Tester
Siemens & Halske Precision Electrical Instruments
"S-H" Standardizing Set
Precision Potentiometers
Scientific Apparatus

"MEGGER"

Trade Mark Registered U. S. Pat. Off.

Features

Drying Period:—10 to 20 minutes, dip or spray.

Electrical Insulation:—In the report of the Underwriters' Laboratories, they state that 2098 is "suitable for general use as an insulating paint, and particularly for use as a protective film on metallic surfaces . . . . a comparatively thin film requiring more than 600 volts to rupture it." When a heavier film was applied with a paint brush, "and no particular care was taken to do an especially good job," nine tests gave breakdown values varying from 650 to 1250 volts, depending on the thickness of the coating.

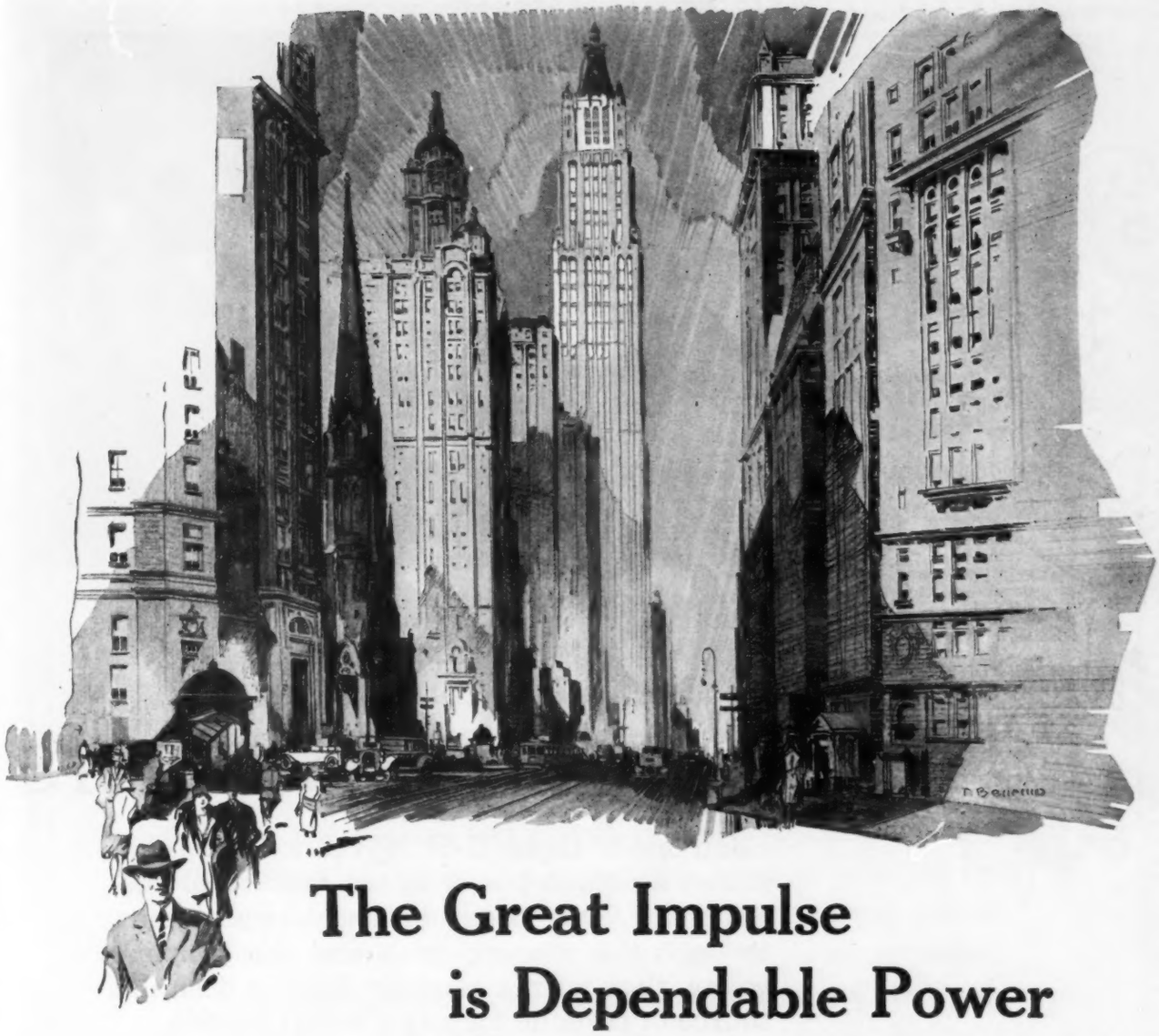
Acid Resistance:—Acid of sufficient strength to disintegrate zinc leaves the paint in an unbroken film.

Alkali Resistance:—Metals partly coated show heavy corrosion on bare parts, but painted portions remain unaffected.

Water Resistance:—Similar tests on iron, either submerged in water or subjected to moist air, show painted surfaces unimpaired, although unprotected parts become deeply rusted.

Heat Resistance:—Temperatures as high as 200° F. tend to soften the film slightly, but it becomes firm again when cool. The paint does not run.

MITCHELL-RAND MFG. CO., 17 VESEY STREET
NEW YORK, N. Y.



The Great Impulse is Dependable Power

New York manufactures a greater volume of goods than any other city in the world.

"Built in" or connected to all types of industrial machines, building services, elevators, or household appliances, G-E Motorized Power aided New York in becoming the greatest industrial city, the largest population center, and the commercial and financial leader of cities. Without motorized power the New York of today would not exist.

General Electric Company
Schenectady, N. Y.
Sales Offices in Principal Cities

Thirty thousand motorized plants and factories—districts with 352,000 workers to the square mile, producing everything from battleships to buttons, from chemicals to clothing.

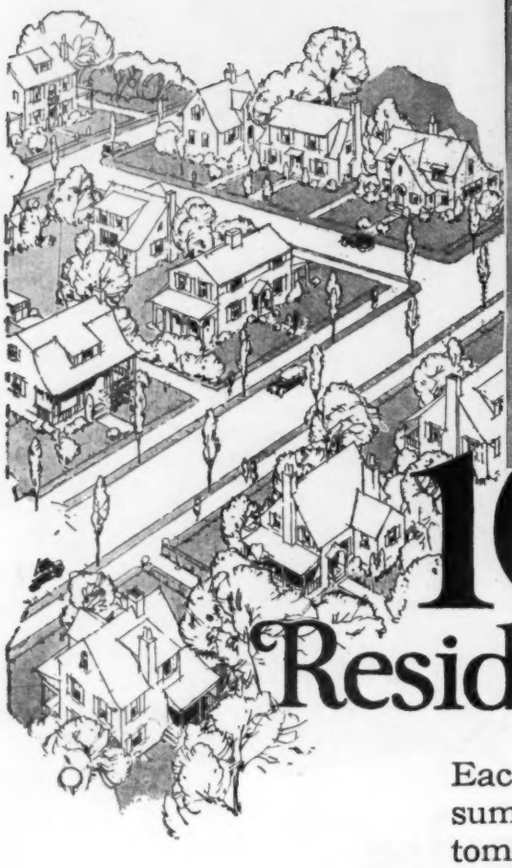
Five billion dollars worth of goods made in a year. The world's richest cargoes loaded and unloaded by motors. Everywhere motors—in single lofts, in skyscrapers, in many-storied factories. That's New York. Every modern city is dependent upon electric power for its very existence, and G-E Motorized Power is adaptable wherever power and motion are required.

There are thousands of different kinds of G-E Motors and applications—from one two-hundredth to 9,000 h.p.—the variety needed by motorized New York and other cities.

And the quality and service built into and around G-E Motors assure the dependability that will meet all these needs.

Motorized Power
—fitted to every need

GENERAL ELECTRIC



10 Residential Customers

Each one of these G-E Novalux Units consumes as much power as ten residential customers. Eleven hours in every twenty-four, through the evening peak and the morning valley, they form a constant load—a desirable source of revenue for any Central Station.

Boston, one of the first cities to illuminate its entire area by electricity, has taken advantage of every successive advance in the art of street lighting. Through the Edison Electric Illuminating Company, it has now added the final touch, on Massachusetts Avenue, by an installation of 1500-candlepower G-E Novalux Units.

This installation reflects the civic pride which is characteristic of all progressive cities, and which will everywhere repay cultivation by utility operators.

This illumination is in step with the modern trend toward higher intensities. Central Station and municipality benefit in equal measure. G-E Street Lighting Specialists will be glad to help solve your lighting problems.

720-26

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

Announcing

THE

GENERAL CHROMIUM CORPORATION

THIS CORPORATION has been formed for the purpose of consolidating certain valuable basic patents, research laboratories, engineering knowledge and facilities for the process of Chromium plating, known as Duro-Chrome.

Under this management a plant is now in operation in Detroit, Michigan, where complete engineering service, job plating and licensing rights may be obtained on a reasonable, commercial basis.

Among the patents and patent applications controlled by the General Chromium Corporation are those owned by Electro Metallurgical Company which patents and patent applications are the result of several years of intensive experimentation on chromium plating by Union Carbide & Carbon Research Laboratories, Inc.

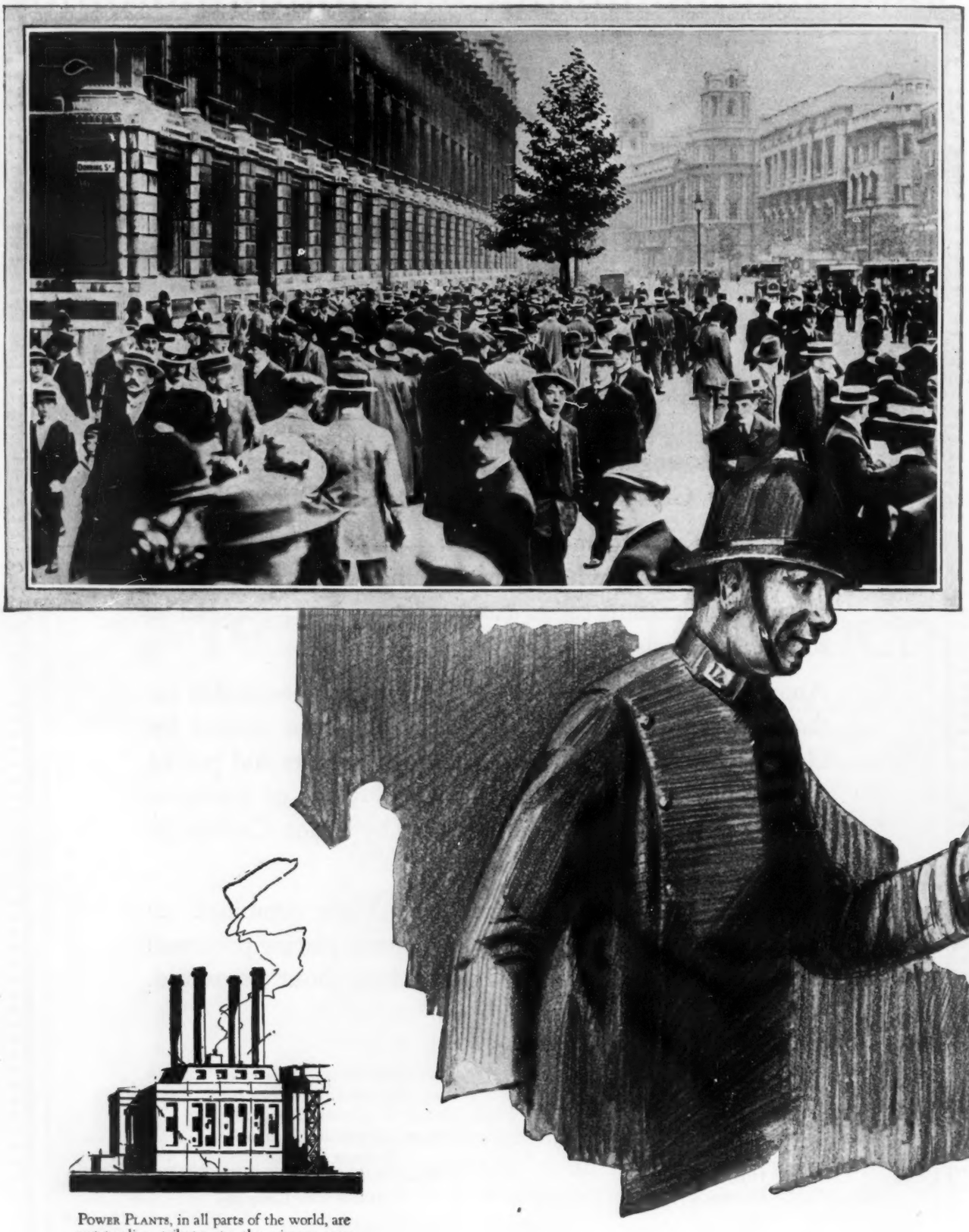
All of the advantages accruing from these combined resources and exclusive successful chromium plating processes are now available to manufacturers throughout the world.

DIRECTORS

FRED J. FISHER	*General Motors Corporation*
F. M. BECKET	*Union Carbide & Carbon Research Laboratories, Inc.*
BENJAMIN O'SHEA	*Union Carbide & Carbon Corporation*
A. E. BALDWIN	*General Chromium Corporation*
C. ROY GLEASON	*Vacuum Can Company*
HORACE MAYNARD	*General Chromium Corporation*
BURTON O. SMITH	*Vacuum Can Company*

GENERAL CHROMIUM CORPORATION

3220 BELLEVUE AVENUE DETROIT, MICHIGAN



POWER PLANTS, in all parts of the world, are outstanding tributes to the pioneer progressiveness and economic influence of International Combustion Engineering Corporation subsidiaries.

No. 10 Downing Street

THE most famous internationally known address in the world, the nerve center of the British Empire and the official residence of the Premier of Great Britain, is on a street called after a native of Dublin, later a resident of New England and a graduate of Harvard College who received his Bachelor of Arts degree from that institution in 1642.

Little did George Downing realize when he returned to England and petitioned King Charles II for the lease of a piece of land within the precincts of St. James Park, that one of the houses he was to build on that site was destined for such fame.

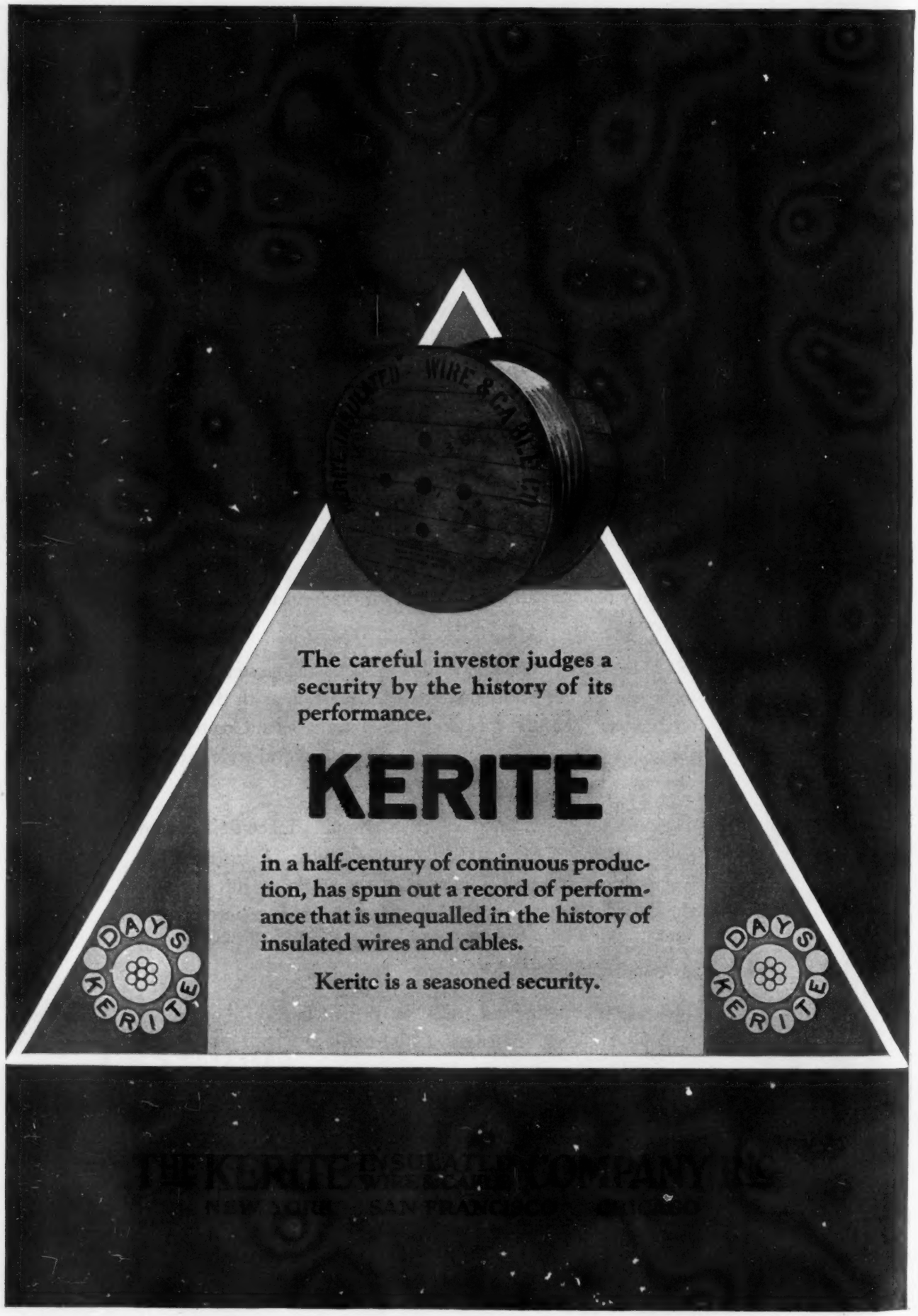
It is this internationally known address that will be in the zone of the super-power plant that is being built by an associated company of International Combustion Engineering Corporation, in London.

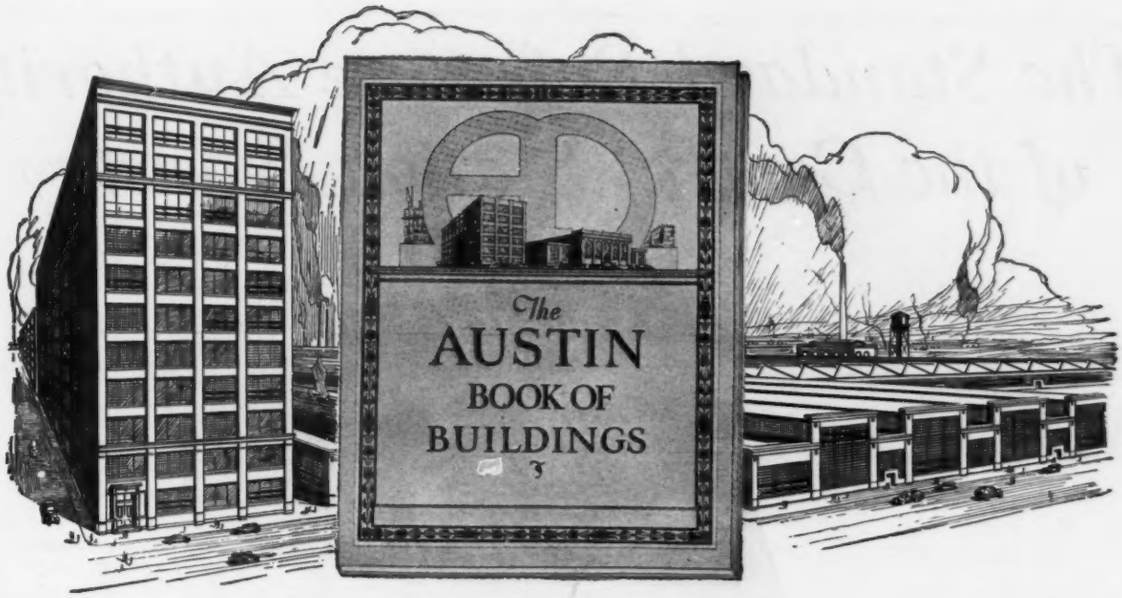
When the City of London decided to spend a large sum of money for a new power plant, there was no question as to the source of the steam generating equipment. International Combustion, through an affiliated company building under world-wide patents, was awarded the contract.

The sun never sets on the British Empire. Likewise, the sun never sets on the outstanding achievements of International Combustion. Like the Union Jack, the stacks of International Combustion power plants are found in the most remote corners of the earth. They are the outposts of pioneer advancement in greater degrees of fuel economy.

The colonies of England make the British Empire impregnable in power. The subsidiaries of International Combustion Engineering Corporation make this great parent organization impregnable in power.

International Combustion Engineering Corporation
International Combustion Building
New York City


The careful investor judges a security by the history of its performance.
KERITE
in a half-century of continuous production, has spun out a record of performance that is unequalled in the history of insulated wires and cables.
Keritc is a seasoned security.
DAYS KERITE
DAYS KERITE



Executives Interested in Their Companies' Building Program Should Have This Book

Showing Latest Trends in Construction with Charts, Costs, Technical Data, etc.

WOULD you like a brief and authoritative statement that would help you determine:

—Whether the new plant buildings you propose shall be Multistory or Single Story?
—How branch plants or warehouses can be successfully located and built?
—How soil-bearing pressure may affect your building costs?
—What the advantages of a wood block floor are as against a concrete floor?
—What kind of a roof structure you should use on a given type of building?

Valuable light on these questions and many others, together with *relative costs of different types of construction*, are contained in the 100-page "Austin Book of Buildings."

This carefully prepared Austin Book of Buildings has helped hundreds of business executives to right decisions on many of the important questions in connection with their new building projects. The facts it presents on Building Design, Construction and Equipment, are supported by Austin's successful and continually growing experience of more than a half-century.

Send the Memo below, or phone the nearest Austin Office for your own copy of this helpful book.

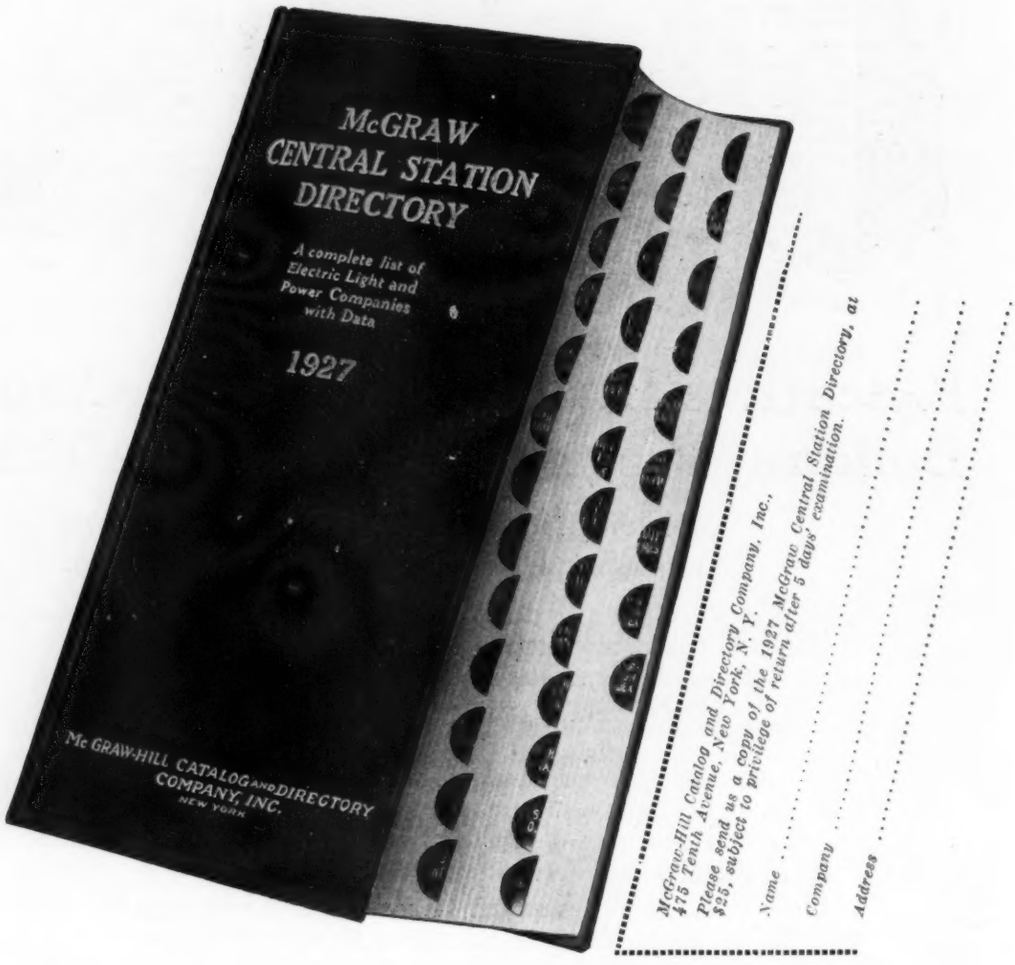
THE AUSTIN COMPANY, *Engineers and Builders*, Cleveland
New York Cincinnati Pittsburgh St. Louis Chicago Philadelphia Seattle Portland Detroit Miami
The Austin Company of California: Los Angeles and San Francisco The Austin Company of Texas: Dallas

AUSTIN

Complete Building Service

Memo to THE AUSTIN COMPANY, *Cleveland*— We are interested in a
_____project containing_____sq. ft. Send me a personal copy of
"The Austin Book of Buildings." Individual_____
Firm_____City_____
EW 7-16-27

The Standard Reference Authority of the Central Station Industry


McGRAW
CENTRAL STATION
DIRECTORY
A complete list of Electric Light and Power Companies with Data
1927
Mc GRAW-HILL CATALOG AND DIRECTORY COMPANY, INC.
NEW YORK
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Please send us a copy of the 1927 McGraw Central Station Directory, at $25, subject to privilege of return after 5 days' examination.
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The authoritative Directory and Data Book of the Central Station Industry since 1904—now available in the completely revised 1927 Edition, just off press.

Contains the correct name and address of every recorded Central Station in the United States, Canada, Mexico, the West Indies, Central and South America—together with the names and titles of the responsible personnel.

Gives the location of the main office, name and location of Holding Companies or Controlling Offices, names and addresses of Serving Companies, as well as a list of State Public Utility Commissions.

Recorded under each station is found up-to-date data covering the Types of Prime Movers and Generators, the Kva. Capacity, A.C. Distribution, Record of Power Purchased and Transmitted, Number of Meters served, etc., etc.

Altogether, the book is a veritable encyclopedia on Central Station practice—invaluable as a sales aid and engineering reference for manufacturers and distributors selling to this field, for consulting and power-sales engineers, public service commissions, financial houses, and, by no means in the least, for the Central Stations themselves.

The convenient coupon above will bring a copy of the Directory to you with privilege of 5 days' free examination.

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Illinois Tax Exempt

$1,000,000

Sangamo Electric Company

(An Illinois Corporation)

7% Cumulative Preferred Stock

Dividends payable quarterly January 1, April 1, July 1 and October 1, beginning October 1, 1927. Redeemable as a whole or in part on thirty days' notice at 110 and accrued dividends. Dividends free from Normal Federal Income Tax and stock is exempt from personal property tax in Illinois. Preferred over the Common stock as to quarterly cumulative dividends at the rate of 7% per annum, and as to assets in event of liquidation at $100 per share and accrued dividends. Annual sinking fund of 7½% of net earnings after Preferred stock dividends and tax reserves to be applied to purchase or redemption of Preferred stock. Transfer Agent: Union Trust Company, Chicago, Registrar: Illinois Merchants Trust Company, Chicago.

CAPITALIZATION

	Authorized	Outstanding
Preferred Stock 7% Cumulative ($100 par value)	$1,000,000	$1,000,000
Common Stock (no par value)	125,000 shs.	125,000 shs.

No Funded Indebtedness

The Company has agreed to make application to list this Preferred stock on the Chicago Stock Exchange.

From a letter to us Mr. R. C. Lanphier, President, has summarized as follows:

BUSINESS: The Company, incorporated in Illinois in 1899, is one of the world's largest manufacturers of alternating and direct current watthour and amperehour meters and auxiliary equipment. Practically all of the Public Utility concerns in the United States, large and small, are users of Sangamo meters. The Company is the sole manufacturer in this country of direct current meters for use on street cars, a majority of all important street railway systems in the United States being equipped with Sangamo "Economy" meters. The business has shown constant development and growth, and present values have been built up entirely by surplus earnings from an original capitalization of $20,000. The Company has developed an electrically wound clock, operated from ordinary light sockets, which has been approved by a number of leading jewelers and horological experts of the United States. The principal plant is located at Springfield, Illinois, and plants of subsidiary companies at Toronto, Canada, and London, England.

EARNINGS: The Company has reported profits in every year of the past fifteen, including the years of general business depression of 1920 and 1921. Messrs. Arthur Young & Company, Certified Public Accountants, report the following net earnings after taxes and depreciation applicable to dividends on the present issue of Preferred stock:

Year Ended Dec. 31	Net Earnings
1922	$441,381.76
1923	610,336.70
1924	484,043.55
1925	531,761.43
1926	594,930.91

The Preferred 7% dividend requirement is $70,000 per annum.

The earnings shown above include only actual dividends received by the Sangamo Electric Company from its subsidiaries. Were the entire equities in subsidiaries' earnings included, the net for 1926 would have been more than $650,000 applicable to dividends on this issue.

Average earnings for the five year period shown above are in excess of $532,000 or more than seven and one-half times the annual dividend requirements on the issue of Preferred stock to be presently outstanding. For 1926, earnings were in excess of eight times such dividend requirements.

FINANCIAL: The balance sheet as at April 30, 1927, after giving effect to the change in capitalization and certain other financial transactions incident to the recapitalization, certified to by Messrs. Arthur Young & Company, reflects current assets of $1,935,467 and current liabilities of $352,287 or a net working capital of $1,583,180, equivalent to 158% of the Preferred stock. Total assets exclusive of patents, good will and similar intangibles amount to $3,060,396, equivalent to 306% of the Preferred stock.

MANAGEMENT: The Company has a thoroughly efficient organization in the manufacturing, engineering and sales departments. Mr. R. C. Lanphier, President, has managed the Company since its inception. Other officers and directors are men who have rendered long and valuable service to the Company and the continuation of their efforts assures excellent management. This issue of stock involves no new financing on the part of the Company.

Legal details concerning this issue of Preferred stock will be passed upon for the bankers by Messrs. Pam & Hurd and for the Company by Messrs. Mayer, Meyer, Austrian & Platt. Audits by Messrs. Arthur Young & Company.

We offer this Preferred stock for subscription subject to allotment, when, as and if issued and received by us and subject to approval of counsel. Delivery of certificates in temporary form is expected on or about June 27, 1927.

Price $101 Per Share Plus Accrued Dividend, To Yield 6.93%

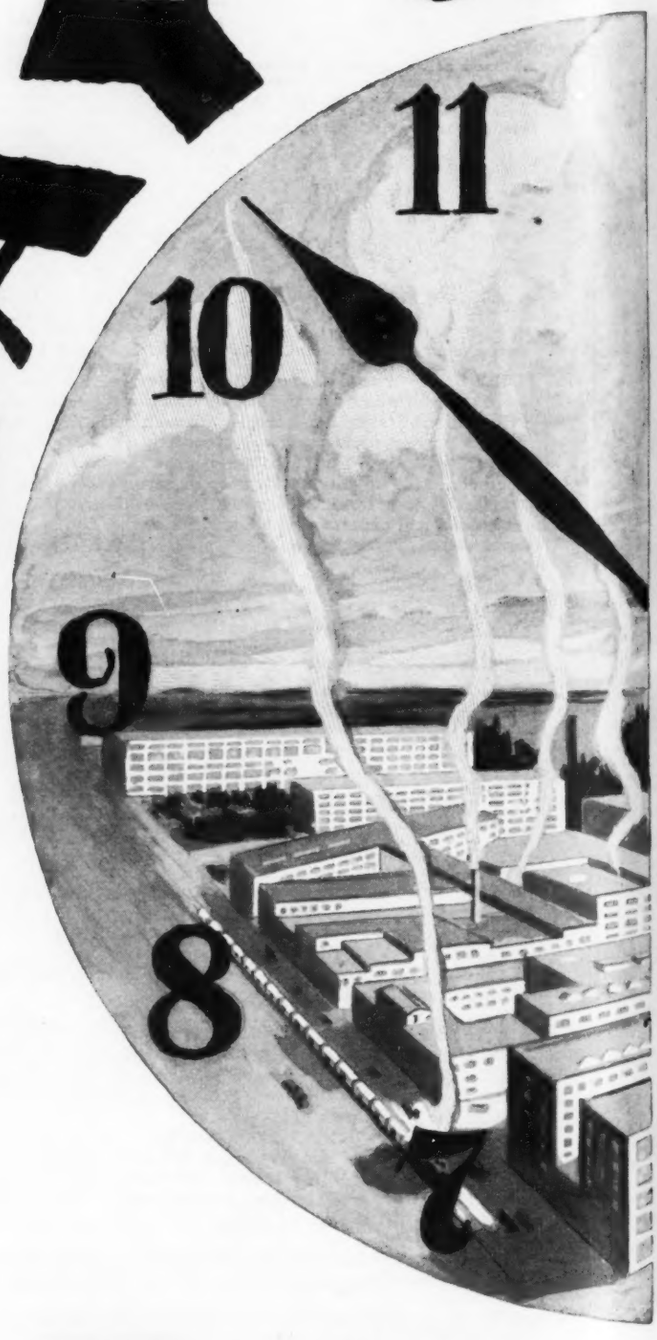
Kissel, Kinnicutt & Co.
New York

Paul H. Davis & Co.
Chicago

Chicago

The statements contained in this advertisement are not guaranteed, but are based upon information which we believe to be accurate and reliable.

DAY & NIGHT



Another

Mr. James H. Faulkner, Industrial Engineer for the Commonwealth Edison Company of Chicago, says: "The Industrial heating load of the resistance type is by far the best load that we can have . . . . It is desirable in improving the power factor of the day motor load, which is very low; it also contributes to the high power factor of the night lighting load."

Thus, the resistance type heating load is an asset to the Commonwealth Edison Company, day and night. Its customers also look on it as an asset to them, as shown by the fact that about 7500 Kw. have been added to their lines in the past two years. One installation produces an income of $79.00 per Kw. year. Mr. Faulkner also says: "The heating load is about to take an upward trend, very fast."

Hoskins

THE WIRE THAT MADE

Reason

Don't these facts suggest significant things to you and your company? And as you go about developing your own heating load, you may, with confidence, recommend Chromel heating units to your customers. It is used by all the leading electric furnace manufacturers because they've learned that, to themselves, the customer and the Central Station, Chromel means satisfaction. If you want helpful technical data on Chromel, send for Catalog E.W.

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4433 Lawton Avenue

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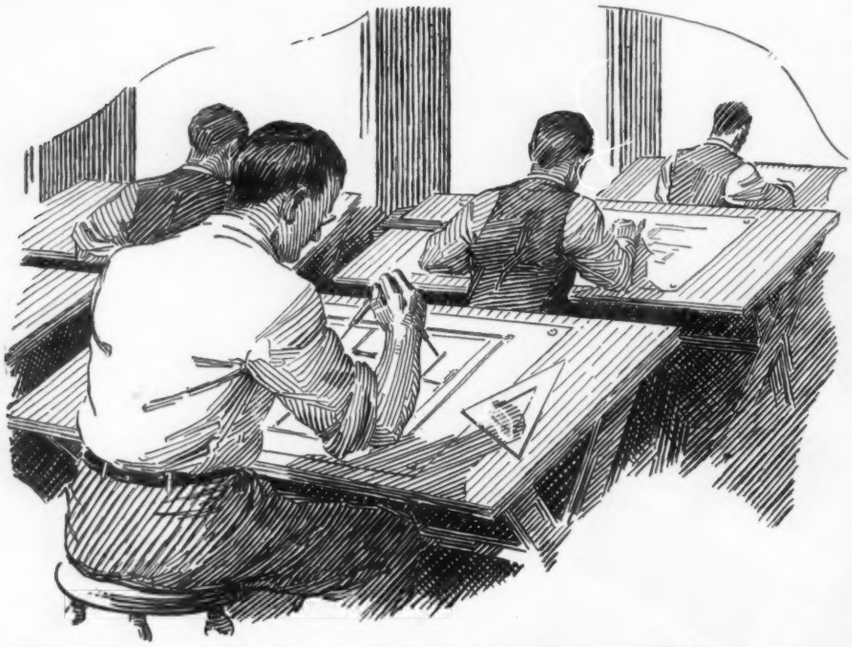
Grand Central Terminal
Cleveland
Leader-News Building
Boston
Park Square Building
Chicago
Otis Building
San Francisco: 1151 Market Street

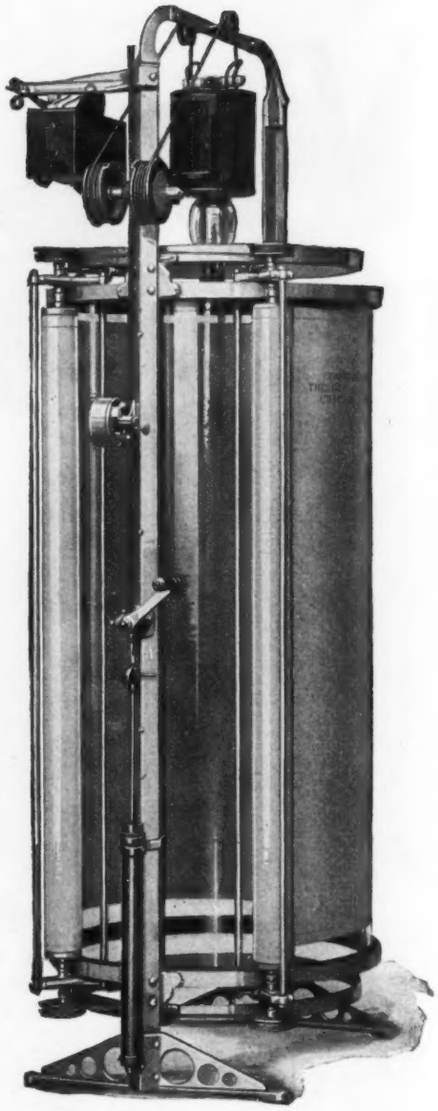
Canadian Rep.: Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ontario

Chromel ◦◦◦

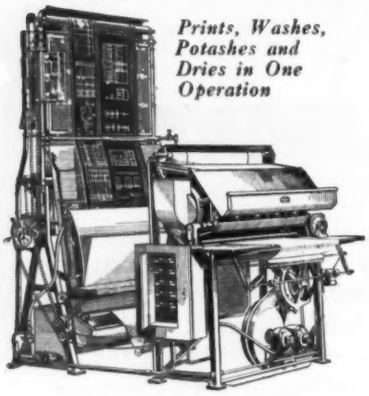
MEANS ELECTRIC HEAT

ELECTRIC HEAT POSSIBLE





Why Not Make Your Own Blue Prints?



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For larger requirements and for continuous printing the Pease Peerless fills the bill 100%. It prints, washes, potashes and dries in one continuous operation up to 120 linear yards of finished prints per hour at the lowest known cost.

Ask for Catalog MP-50.

Every Central Station can cut blue-print costs and save considerable time by installing their own blue-printing equipment. If you use but a small quantity of blue-prints each month, the Pease Vertical Blue-Printing Machine will prove a profitable investment and increase your operating efficiency.

You can install the Pease "Vertical" in a corner of your drafting room and within four minutes after the tracing is completed, you can have a clear and prominent, perfectly finished blue-print.

With your own blue-printing equipment there will be no lost time in sending tracings out, no more delivery promises that are not fulfilled, and no more chances for errors as your work is under your own control at all times.

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THE C. F. PEASE COMPANY
850 N. Franklin St., Chicago, Illinois

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BLUE PRINTING MACHINERY

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The 22,000,000th Western Electric telephone

IT was finished only recently. But it began well over a generation ago. It began, not in the shape of a telephone, but in the shape of an idea strong enough to be repeated in 22,000,000 telephones—the idea that every Western Electric telephone must be as good as human ability coupled with efficient machines could make it.

This ideal of the founders of the business still inspires the workers of today. That it will continue to be their aim is one assurance that telephone service in America will continue to maintain its supremacy.

Western Electric

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The consultants on these two pages are competent to advise you on your engineering, construction or plant management problems, *but*—

You may also need men to complete your organization of employees—in either responsible executive or operating positions. You can find them through the Employment Columns of the Searchlight Section of ELECTRICAL WORLD—possibly through their advertisements under Positions Wanted in this issue, or your own announcement in the Positions Vacant Columns of the next issue.

Use the Employment Columns of ELECTRICAL WORLD whenever you are looking for a choice of competent and experienced men.

The Searchlight Section in this issue follows this page.

SEARCHLIGHT SECTION

USED MACHINERY & NEW—BUSINESS OPPORTUNITIES

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 4 cents a word, minimum 75 cents an insertion, payable in advance.

Positions Vacant and all other classifications, 8 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of any of our offices count 10 words additional in undisplayed ads.

Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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8 to 15 inches..... 4.60 an inch

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E.W.

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1924-5 electrical engineering graduates to be trained for sales positions; several openings exist for men of exceptional ability. The Electric Controller & Manufacturing Co., 2700 E. 79th St., Cleveland, Ohio.

ELECTRICIAN wanted, thoroughly experienced on all sizes and kinds of motors in industrial plants, manual and automatic a.c. and d.c., all voltages up to 2,300. Must be able to do line work, wind armatures and stators, be familiar with cable work and substation operation. Must be willing to do turn work. Excellent working conditions, good opportunity, and chance for advancement. Location, capital district New York State. Give qualifications, experience and references in first letter. P-973, Eletrical World, Tenth Ave. at 36th St., New York.

ONE of largest power companies in Southwest has opening for several high-grade substation designers, first-class mechanical engineer, a number of openings for high-grade electrical and mechanical construction foremen, transmission line foremen, also opening for high-grade resident engineer capable of taking complete charge of construction of substations, transmission lines, and power plants. P-970, Electrical World, Bell Tel. Bldg., St. Louis, Mo.

EMPLOYMENT SERVICE

IF YOU are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established sixteen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not an employment agency. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 262 Main Street, Buffalo, N. Y.

ELECTRICAL WORLD readers find our individual, confidential service effective in making new connections. Personally planned by Jacob Penn, the eminent employment authority. Refund agreement. Not agency. Jacob Penn, Incorporated. 816 Parkmurray Bldg., New York.

EMPLOYMENT AGENCY

AMERICAN ENGINEERS SERVICE, Emich Bldg., Pittsburgh. Require graduate engineers for university teaching; factory drafting rooms; sales engineering, designers, motors, generators, steam turbines, substations; plant engineers; meter experts; statisticians; mine electricians.

Graduated from Swedish Technical Colleges

Young Electrical Engineers working in U. S. A., wanted for estimating and projecting work. Full knowledge of the English language required. Engineers with business experience as well as practical experience preferred. State age, education, experience, and salary expected. Give references. Reply to Asea, Dept. Fu, Västeras, Sweden.

POSITIONS WANTED

ACCOUNTING executive with one of the larger public service corporations serving Midwestern territory, desires Eastern location. Age 38. Thoroughly experienced in all branches of public utility accounting and financing. Twenty years' service with present company. PW-967, Electrical World, 1600 Arch St., Phila., Pa.

ELECTRICAL engineer with public utility or as sales engineer by technical graduate. Age 39, 11 years' experience in central station work. PW-949, Electrical World, 7 So. Dearborn St., Chicago, Ill.

GRADUATE electrical engineer, desires position with public utility, electric railway or industrial concern. Experience includes the following: two years' electrical manufacturer's course, (1½ years test), two years construction and maintenance, and 1½ years operating. PW-974, Electrical World, 1600 Arch St., Phila., Pa.

GRADUATE engineer, 18 years' successful electrical and mechanical experience. Thoroughly familiar with construction, distribution, operation, and industrial power applications. Desires position with public utility or industrial company. PW-956, Electrical World, 7 So. Dearborn St., Chicago, Ill.

MANAGER. Technically trained executive, eighteen years' broad experience in public utility work, including construction, operation, new business management, new properties negotiations, public relation activities, power and industrial heating sales, successful record, desires connection as property manager. PW-969, Electrical World, Bell Tel. Bldg., St. Louis, Mo.

MANAGER or superintendent available on reasonable notice. Successful record of efficient construction, operation, maintenance and management of public utilities. Good new business man. Maintains excellent public and employee relations. Character, health and references the best. PW-964, Electric World, Tenth Ave. at 36th St., New York.

MANAGER, position wanted as manager of central station local office, to supervise general office wants and retail appliance salesroom. Qualifications and recommendations will be gladly furnished on request. PW-932, Electrical World, 7 So. Dearborn St., Chicago, Ill.

METERMAN, capable of taking charge of meter department; years' experience in meter work, testing, repairing, installing and primary meters. Now employed. PW-971, Electrical World, 1600 Arch St., Phila., Pa.

METERMAN, 28, married, nine years' practical experience in maintenance of electrical measuring instruments, a.c. and d.c. Sufficient training to supervise small meter department. PW-972, Electrical World, 7 So. Dearborn St., Chicago, Ill.

BE A METER ENGINEER

Get in the new profession. We can teach you Meter Engineering *by mail* at your own home during spare time. Successful graduates everywhere.

Earn $3,600.00 a Year

Central stations *must have Electrical Meter Engineers.* They pay high salaries. *Write today.* Just your name and address on a postal and we will send you full particulars free. Ft. Wayne Correspondence School, Dept. 46, Ft. Wayne, Ind.

POSITIONS WANTED

METERMAN—Technical graduate, age 25, married. Experienced in single-phase and poly-phase meter test. Also some experience in electrical construction and maintenance. PW-953, Electrical World, 1600 Arch St., Phila., Pa.

SUPERINTENDENT, experience power plant design and construction. Operation and maintenance of public utilities and industrial plants. Boiler room economy. Coal and ash handling equipment. Very successful builder of efficient operating staff. Character and references the best. PW-968, Electrical World, Guardian Bldg., Cleveland, Ohio.

YOUNG man, age 20, with technical training in electrical drafting, desires a position at electrical drafting. PW-950, Electrical World, Tenth Ave. at 36th St., New York.

SALESMEN WANTED

Refrigerators

A public utility operating a large number of gas and electric properties in the East, desires to secure the services of several experienced salesmen to sell gas and electric refrigerators, as well as electric ranges, for domestic and commercial use, preference given to those who understand the installation and maintenance of these appliances. Kindly state experience, reference, compensation expected, when you can report for duty, and enclose photo with first letter. Steady all year positions in a progressive sales organization. SW-946, Electrical World, Tenth Ave. at 36th St., New York.

Sales Engineers

Experienced with carbon brushes and their application Liberal commission, protected territory. Give past experience in first letter. SW-955, Electrical World, 1600 Arch St., Phila., Pa.

When Writing Your Ad

Provide an indexing or subject word.

Write it as the first word of your ad.

If it is a Position Wanted or Position Vacant ad, make the first word the kind of position sought or offered.

This will assure proper classification in the column.

The right is reserved to reject, revise or properly classify all Want Advertisements.

Proper Classification increases the possibility of Prompt Returns

J. L. HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT

801-807 Williams St. North Bergen, N. J.

Telephones: Palisade 2600-2601

MOTOR GENERATOR SETS

300 kw 250/500 v. 3 ph. 60 cy. 2300 v. Westinghouse synch. motor generator set.
1—250 kw. 250 v. G. E. Generator 3 ph. 60 cy., 2200 v. synchronous motor.
200 kw., 600 r.p.m., 250 v. Gen., 3 ph., 60 cy., 440/2200-v. synchronous motor.
150 kw., 600 r.p.m., 250 v. Gen., 3 ph., 60 cy., 220/440 v. G. E. synchronous motor.
1—125 kw. 250 v. Westinghouse synchronous generator motor set.
1—100 kw. 250 v. D.C. 2300/440 A.C.G.E. syn. motor generator set.
100 kw. 250 v. Gen. 900 r.p.m. 2200 synchronous motor.
1—75 kw. 250 v. Generator, 3 ph. 60 cy. 2200 v. synchronous motor.
1—50-kw. 250 volt, Westinghouse, 3 phase, 60 cycle 220/440 volts.
1—37½ kw., 900 rev., 110 v., D.C., on same base with 60- hp. Lincoln 220 v., sq. cage motor
10-20-25-40 kw. 125 v. Exciter Sets.
10-20-30 kw. Balancer Sets.
—5 kw. Battery Charging Sets.

TRANSFORMERS

3—75 kw. Maloney transformers R.E. single phase 60 cy. oil cooled indoor—2200/220-110 v. NEW
15—5 kw. to 30 kw., 3 ph. Pole Type, 2200/1100 440/220/110 G. E.

A. C. GENERATORS

No.	Kw.	Rpm.	Volts	Ph.	Type
1	300	450	2300	3	G. E. P.
1	200	600	440	3	Westg.
2	150	600	220/440/2200	3	Wagner
2	100	900	2300	3	G. E.
1	75	900	2300	3	G. E.
1	50	1200	220/440	3	G. E.

A. C. ENGINE GENERATOR SET

200 kw., 220/440 volt, 3 phase, 60 cycle, G. E. Rice & Sargent 4 valve.

A. C. MOTORS—3 PHASE, 60 CYCLE

No.	Hp.	Rpm.	Volts	Type
1	500	360	220/440	Westg. HF. sl. rg.
1	400	450	2200	G. E. synch.
1	300	300	2200	Westghse. synch.
4	200	514	2300/440	G. E. synch.
1	180	400	440/2300	Burke sl.rg. 3 brg.
2	175	600	220/440/2200	Wagner synch.
1	150	900	2300	G. E. synch.
1	150	600	2200	Westg. sq. cage
1	150	600	2200	G. E. MT. sl.ring.
1	150	1200	220	Elec. Machy. syn.
1	125	900	440/2200	Cr. Wheeler
1	100	900	440/2200	G. E.
1	100	900	220/440/2200	West
1	75	600	220	G. E. sq. cg.
1	75	720	220	Westg., C.W.
1	75	490	440	Allis-Chal. S. R.
1	75	900	2200	G. E. KT.
1	60	1200	220	G. E. sl. rg.
1	60	300	220/440/2300	Fair.-M. Syn. Mr.
3	50	900	220	G. E. sq. cg.
1	50	900	2200	G. E. B.
1	50	1200	220/440	Wagner sl. rg.
1	40	1700	220/440	Westg. sl. rg.
1	25	1200	440	G. E. K.
1	25	900	220	West C. S.
1	7½	900	220/440	G. E. MT.
2	2	1800	220/440	G. E.

(2 Phase Motors on request)

BRAND NEW MOTORS

8	7½	900	220–440	Gen. Electric	MT
1	10	1200	220–440	Gen. Electric	MT
3	15	1200	220–440	Gen. Electric	MT
1	15	1200	220–440	Gen. Electric	KT
5	25	600	220–440	Gen. Electric	KT
3	25	900	220–440	Gen. Electric	KT
1	30	900	220–440	Gen. Electric	KT
3	30	1200	220–440	Gen. Electric	KT
1	40	1200	220–440	Gen. Electric	MT
1	40	900	220–440	Gen. Electric	KT
1	40	1200	220–440	Gen. Electric	KT
1	60	720	220–440	Gen Electric	KT

D. C. GENERATORS—250 VOLT

No.	Kw.	Rpm.	Type
1	250	450	G. E.
1	200	500	West.
1	150	600	G. E.
1	100	720	G. E.
1	75	450	Diehl
1	50	600	Westg.
1	30	1000	Westg.

(Smaller sizes on request)

D. C. GENERATORS—125 VOLT

5, 10, 20, 22, 35, 50, 2-100 kw.
3—21 kw. 1250 r.p.m. Sprague

D. C. MOTORS—230 VOLT

No.	Hp.	Rpm.	Type
1	350	450	G. E.
1	200	550	West.
1	150	1100	West. SK
1	100	625	Westg. type S
1	80	500	Allis-Chalmers
2	75	475	Westg. type S
1	50	560	Westnghse SK
1	50	200	Diehl
1	50	650	Sprague
1	40	400	Diehl
1	40	1300	Diehl
1	35	200	Diehl
1	35	700	Cr. Wheeler
1	35	420	Diehl
1	20	665	Diehl
1	20	200	Diehl
1	20	900	Diehl
1	15	1050	Cr. Wheeler CM
1	10	375/750	Westg. S var. sp.
8	10	1350	Rochester

(Smaller sizes on request)

D. C. MOTORS—125 VOLT

1	150	600	G. E.
1	100	675	G. E.
1	80	600	G. E.

1—65 hp. General Electric Type CL 550/605 motor.

3	25	1200	Sprague
1	20	650	G. E.
1	15	775	SK Westg.

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0100

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1—75 HP Allis-Chalmers	720 RPM
1—75 HP Westinghouse	600 RPM
6—60 HP GE.	900 RPM
4—60 HP GE.	1200 RPM
2—50 HP Westinghouse	900 RPM
6—50 HP Wagner	1200 RPM
4—40 HP GE.	1200 RPM
10—35 HP GE.	1200 RPM
2—35 HP GE.	900 RPM
4—30 HP GE.	1200 RPM
1—30 HP GE.	900 RPM
12—25 HP GE.	1200 RPM
10—20 HP GE.	1200 RPM
60—15 HP Wagner Type BW	1200 RPM
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1—200 HP Westinghouse	700 RPM
1—125 HP Wagner	900 RPM
1—100 HP Wagner	900 RPM
3—75 HP GE.	514 RPM
1— 75 HP Westinghouse	720 RPM
1— 75 HP GE.	900 RPM
1— 60 HP Wagner	900 RPM
1— 50 HP Westinghouse	1200 RPM
1— 35 HP Wagner	900 RPM
1— 35 HP GE.	720 RPM
2— 25 HP GE.	1200 RPM
2— 20 HP Allis-Chalmers	1200 RPM
1— 25 HP Westinghouse	1200 RPM
1— 20 HP Allis-Chalmers	900 RPM
1— 15 HP GE.	720 RPM
1— 10 HP GE.	1200 RPM

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Squirrel Cage MOTORS

Qu.	*H.P.*	*Make*	*Type*	*Volts*	*Speed*
1	15	Westinghouse	CS	220/440	860
1	20	Union	MA	220/440	1800
1	20	General Electric	IL	220/440	1200
1	25	Union	MA	220/440	1800
1	25	General Electric	KT	220/440	860
1	30	Westinghouse	CS	440/220	1755
1	30	Westinghouse	CCL	220/440	1120
1	30	General Electric	KT	220/440	860
3	30	Westinghouse	CS	220/440	870
1	30	General Electric	KT	220/440	600
2	75	General Electric	IK	550	1740
1	100	Lincoln	.....	2200	1800
1	290	General Electric	ATB	2200	600

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1—18/23-hp. Electro Dyn., 20S, 310/1240 r.p.m.
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1—15-hp. Westing. SK-100L, 500/1500 r.p.m.
2—15-hp. Westing. SK-90, 825/1650 r.p.m.
6—11¼-hp. Westing. SK-90, 500/1500 r.p.m.
1—10-hp. Westing. SK-91, 250/1000 r.p.m.
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Hp.	Volts	Make	Speed
200	440-220	G.E.	450
200	2200	G.E.	1800
200	220-440	G.E.	600
150	2200	G.E.	600
150	550	G.E.	600
150	220-440	G.E.	600
100	2200	G.E.	720
100	440-220	G.E.	720
100	2200	G.E.	1800
60	550	G.E.	900
50	2200	G.E.	600

Sq. Ca. Motors—3 Ph., 60 Cy.

150	2200-440	G.E.	720
125	2200-440	G.E.	720
100	220-440	G.E.	1200
100	440-220	G.E.	720

Direct Current Motors

125	125	900	General Electric	RC
100	230	950	General Electric	RC

Direct Current Generators

Kw.	Volts	Speed	Make	Type
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90	125	1150	General Electric	RC
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50—100-200-300-400-500-600-800-1000 hp.

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1—75 hp. General Electric, A.C., 60-cycle, 3-phase, 220-volt, 900 r.p.m.; with controller and resistance coil.

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To Meet Any Need.
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1—100-kw. Uniflow Unit.
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2—150 kw., 250 volt, D.C. Westinghouse Turbo Sets, complete.
1—150-kw. Ridgway Syn. Motor Generator Set.
1—150-kw. G.E. Syn. M.G. Set, 140 volt.
1—100 kw., 4 valve, 3 phase, Engine Generator.
1—300 kw., 450 r.p.m., 3 phase, belted.
1—150 kva., dir. conn. to Corliss Engine.
6—100 kva., 4600/2300/220/110 Transformers.
1—100 kw., 4 valve, D.C., 250 volt.
1—100 kw., 4 valve, D.C., 125 volt.
1—250-hp. G. E. Syn. Motor, 600 r.p.m.
1—185-kva. Corliss Engine Generator, direct conn.
1—75-kva. G. E., belted generator.
1—35 kw., S.K., Westinghouse, M.G. Set, 125 v.
1—40 kw., Type S, Westinghouse, M.G. Set, 250 volt.
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Lakin-Allen Electric Company
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3 Phase, 60 Cycle Generators

150 kw., 900 r.p.m., 240 v., General Electric.
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500 kw., Westinghouse, 3-60-2200
250 kw., Allis Terry, 3-60-2400
100 kw., Gen. Elec., 3-60-600
75 kw., G. E.-Terry Dual Exciter 125 v.
250 kw., Diehl-Kerr, 125 v. D.C. NEW

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10—600 hp. B&W Straight Tube Boilers six to nine years old, 200 lb. steam pressure ASME Std. with 100° superheat and underfeed stokers with all trimmings as operated.
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2—150 kw., West., Syn., 3-60-6600-2200-250 v.
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2—500 kw. 3-60-220 D.C. to 750 hp. 4-cylinder Vertical Engines, all equipment **Excellent.**

See Engineering News-Record for other equipment.

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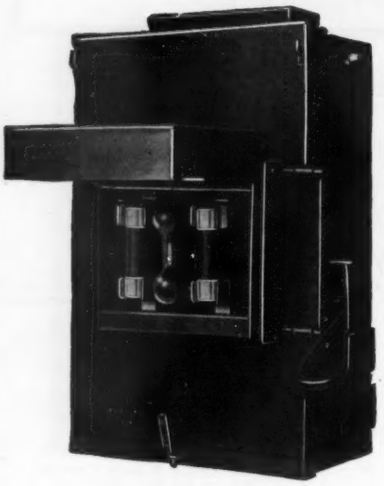

60 Amp. Meter Switch.
Main cover locked or sealed. Switch off, fuses disconnected from line and load, and accessible for inspection or replacement.

Absolute Safety.

Underwriters "AA" Classification
30 to 600 Ampere, 250 Volts
30 to 100 Ampere, 600 Volts

Comments of visitors at the N.E.L.A. Convention were unanimous that the most economical safety switch for the Utility Company is one in which all terminals and connections are visible and accessible to the wireman, inspector or tester, and in which the fuses may be depended upon to carry full rated capacity at normal load.

Write for booklet
"Fuse Failure Unnecessary."

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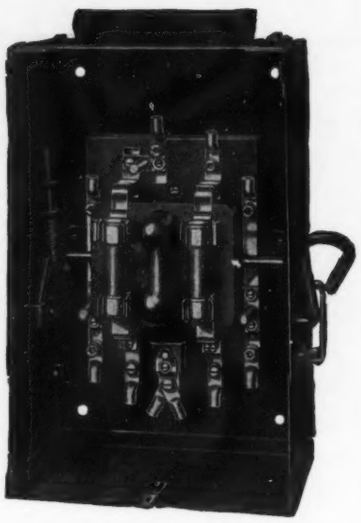
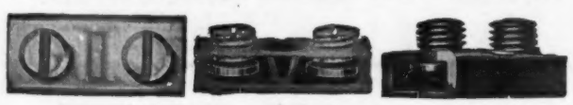


60 Amp. Meter Switch.
Main cover removed, showing accessibility for wiring and testing, also radiating space for fuses.

No Unnecessary Fuse Failure.

For that added economy point in installing fixtures

SHERMAN
Solderless
Fixture Connectors



Top View | Cross Section Showing Bridge | Corner View

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Solderless **Practical**
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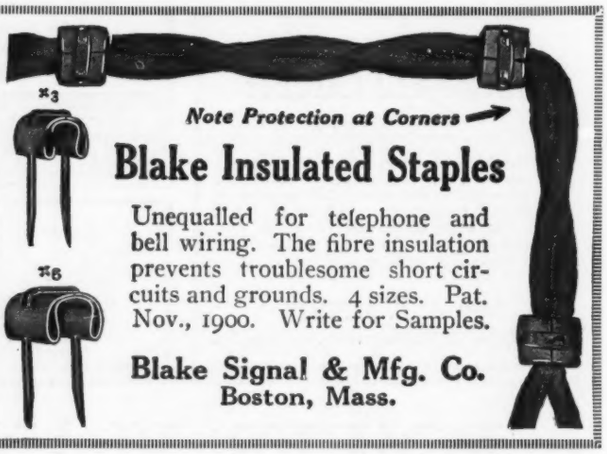

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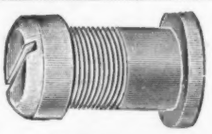

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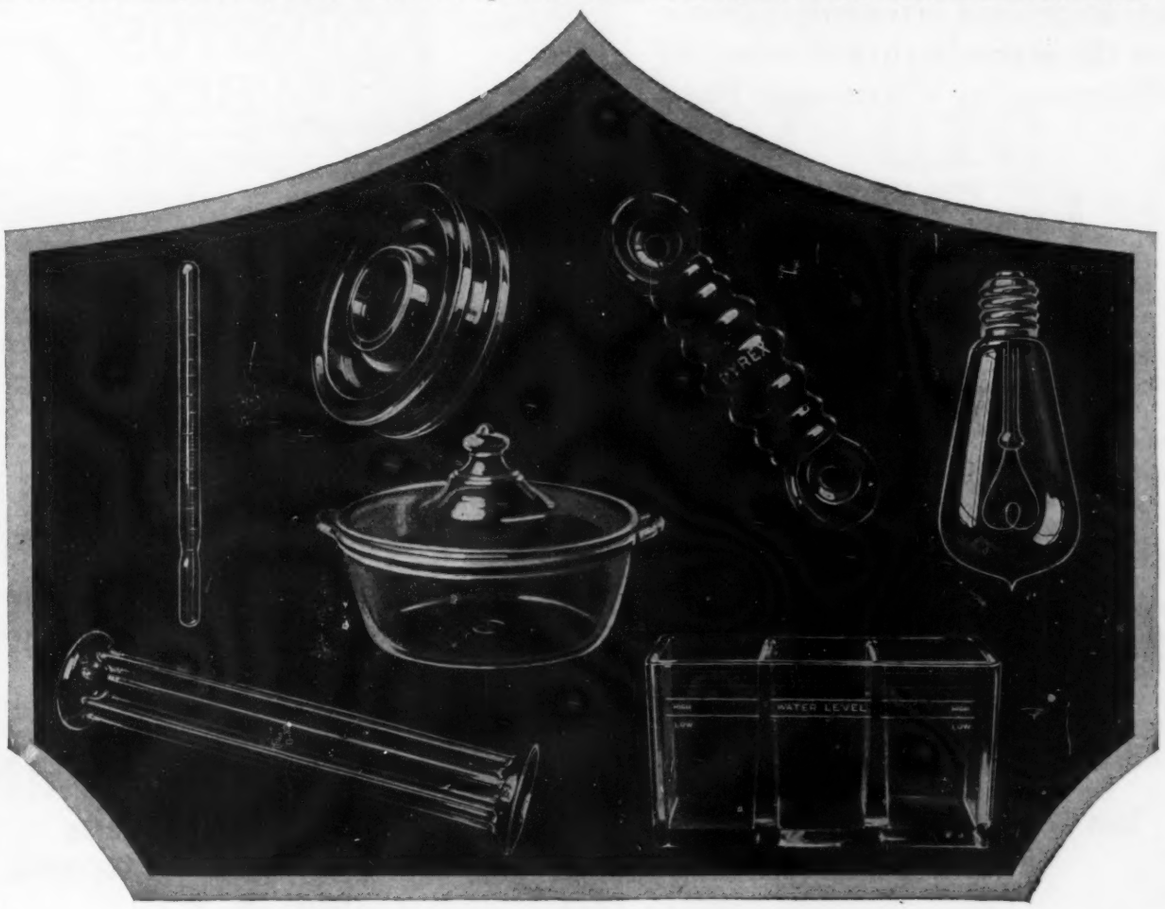

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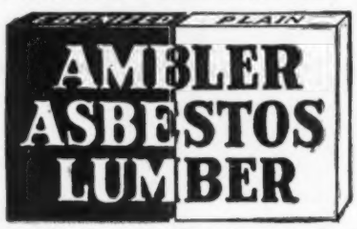

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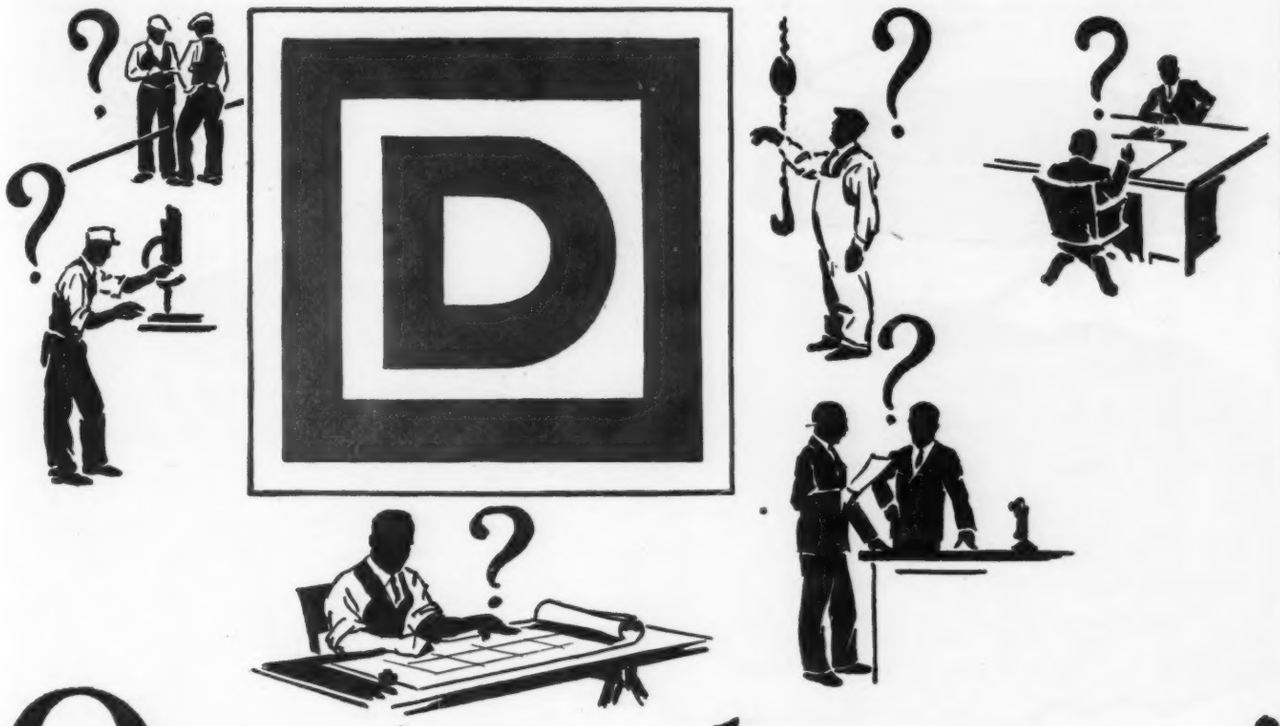

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Follow the order-taker about his daily work, and listen to this little game of "question and answer", as it is played where fly-by-night products seek a foothold or cut rates try to compete with honest values:

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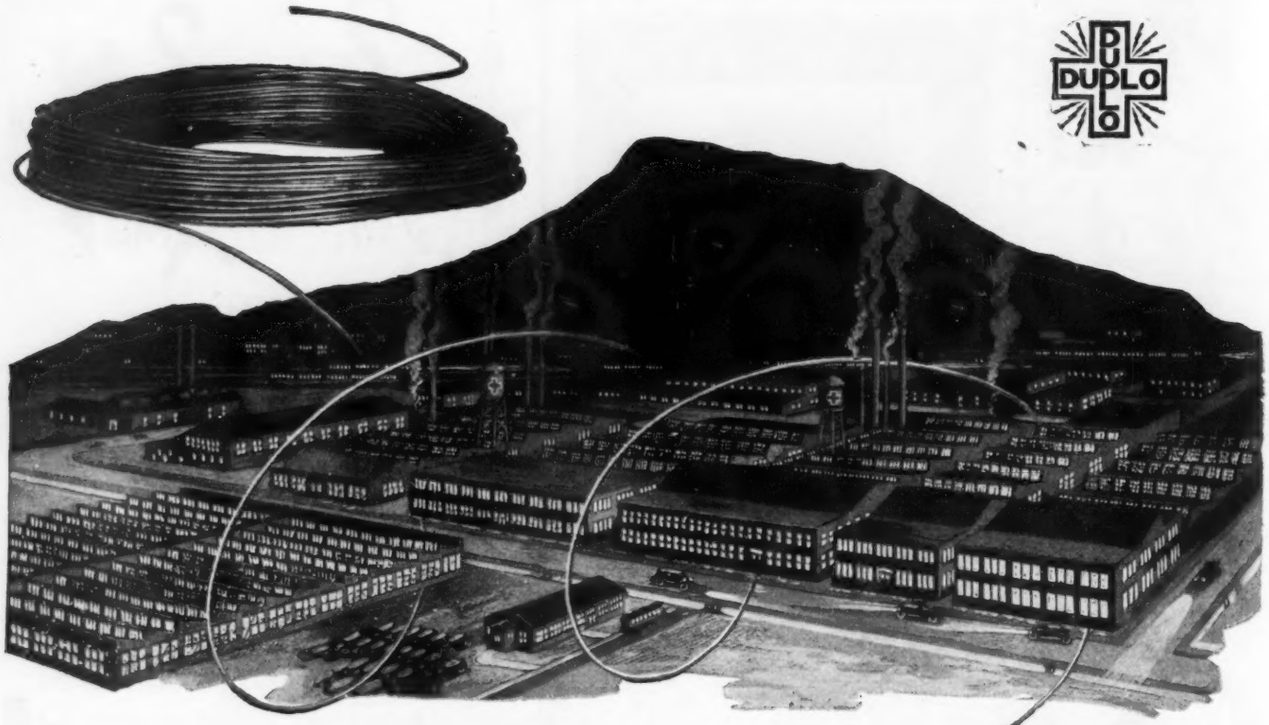
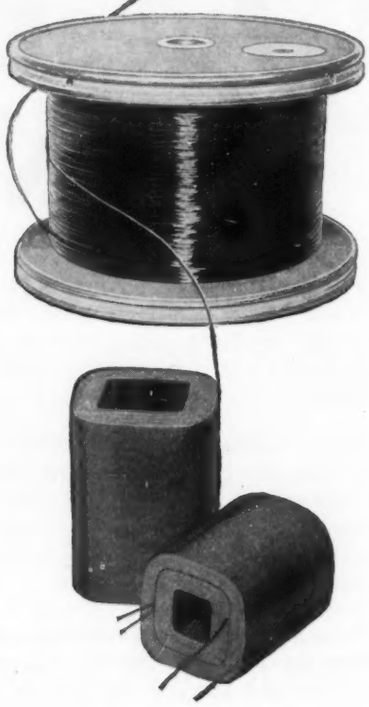


From Copper Rod to Magnet Wire and Coils!



The Dudlo production cycle is complete, controlling all materials and processes from rod to coil.

Beginning with the bare copper rod, the drawing, annealing, insulating and winding is completed in the Dudlo factories, under scientific, progressive inspection. This system of inspection prevents hidden flaws and insures uniform high quality.

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No coil is any better than the wire in it and no electrical apparatus is any better than its coil. The real competition is always quality. Manufacturers of electrical apparatus stand or fall upon the sustained and uninterrupted service their products give.

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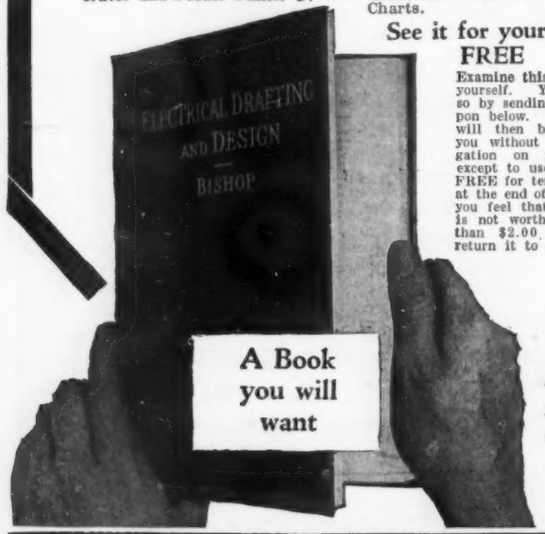

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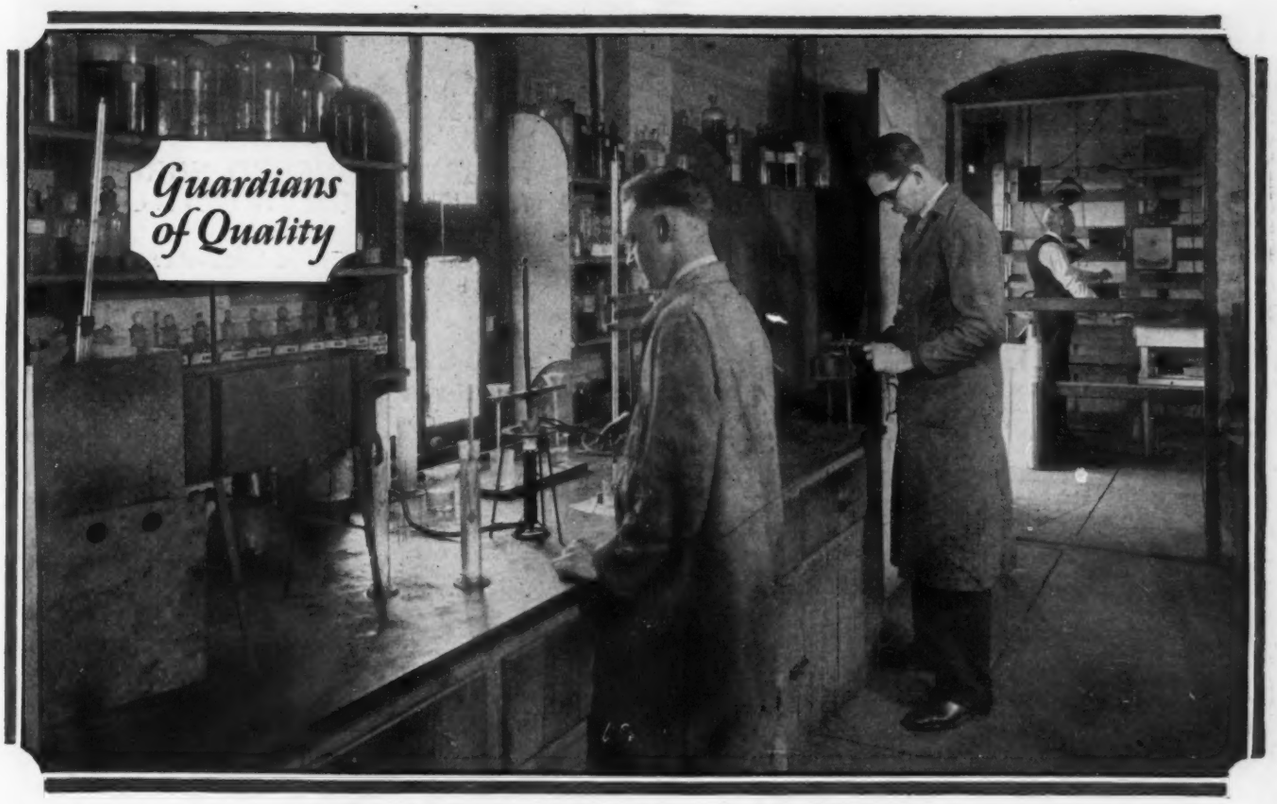

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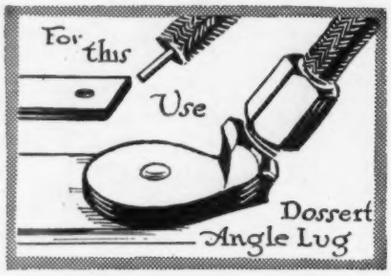

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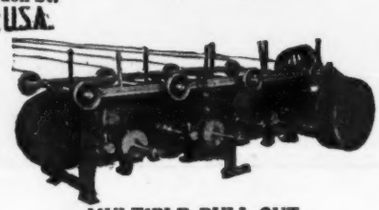

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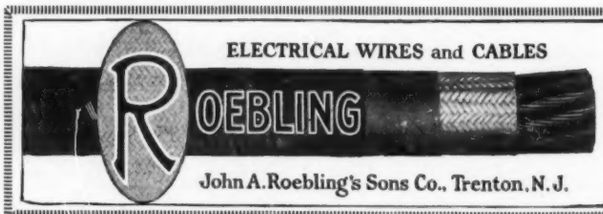

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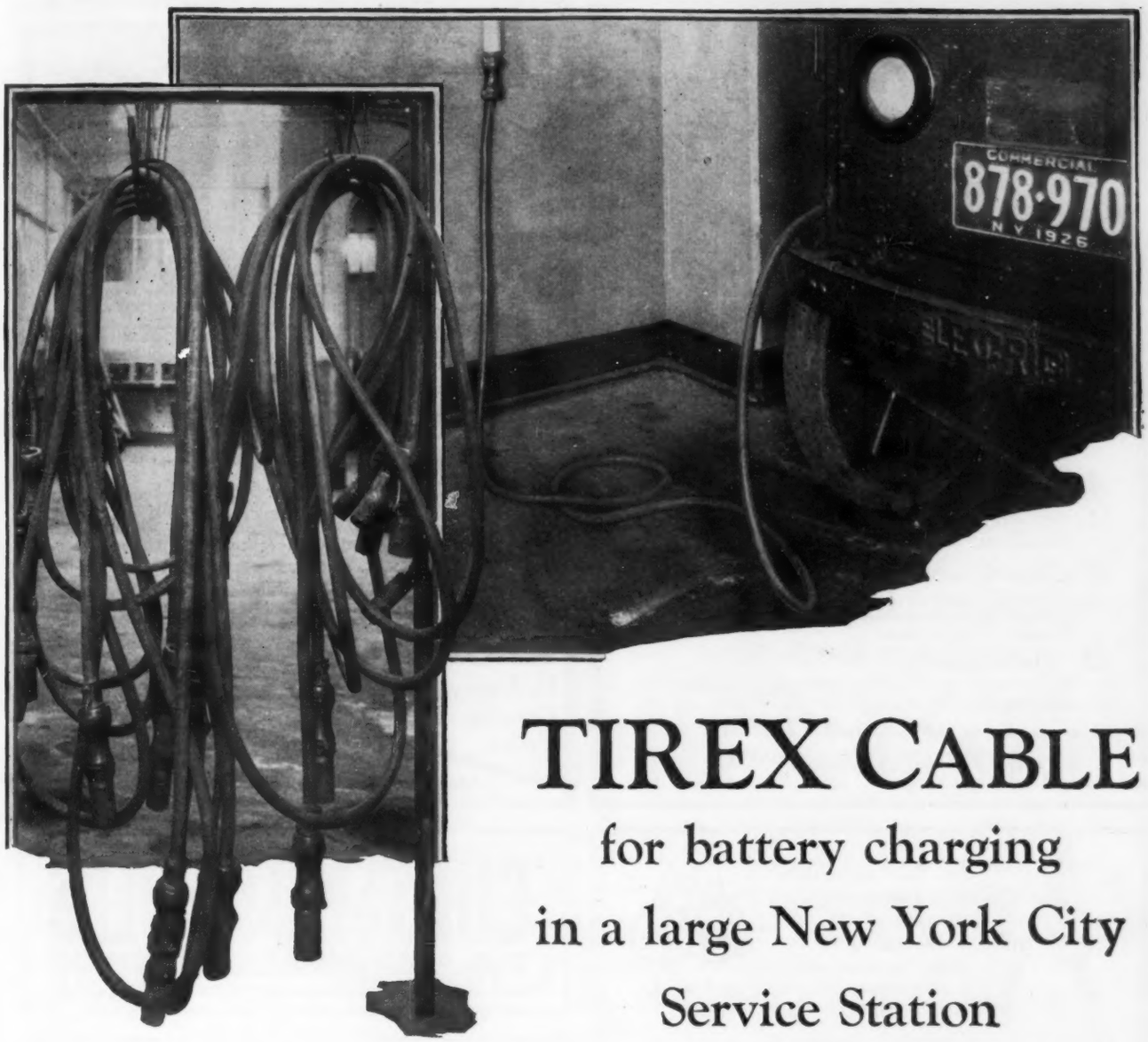

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In one of the largest and best equipped service stations in New York City, Tirex Cable is used exclusively for battery charging.

Dragged over concrete floors, pulled from place to place, even accidentally run over by vehicles, Tirex Cable gets rough usage aplenty. Perhaps the features most appreciated by the garage man, however, are the remarkable flexibility and the resistance offered by the selenium rubber outer jacket to the attacks of the ever present acids.

The Tirex outer jacket will withstand rough treatment for long periods of time because of its unexcelled toughness—the result of selenium curing. Selenium cured rubber, a product of the Simplex laboratories, is available only on Tirex Cables.

Any cable that will withstand the rough usage demanded by this New York commercial garage, will likewise give good service in any industrial plant, central station or substation for battery charging work. Write for full details and quotations.

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made in sizes up to **15,000** *volts*

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For medium voltage lines

Insulate with Glass

Advantages!

(1) Transparency
Exposes internal defects

(2) Non-Porosity
Eliminates Moisture Absorption
Sustains dielectric strength
Prevents deterioration

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Insures uniform insulating properties throughout each insulator.

Up to 15,000 standardize on Glass

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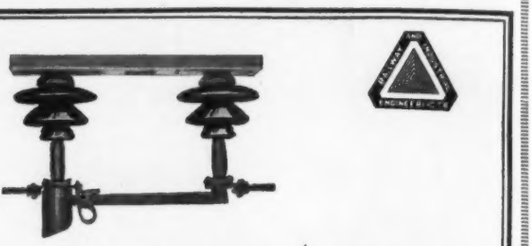

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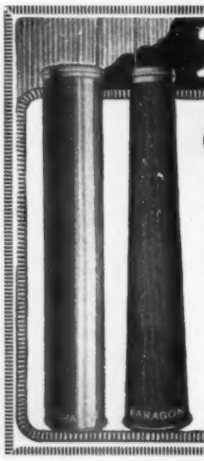

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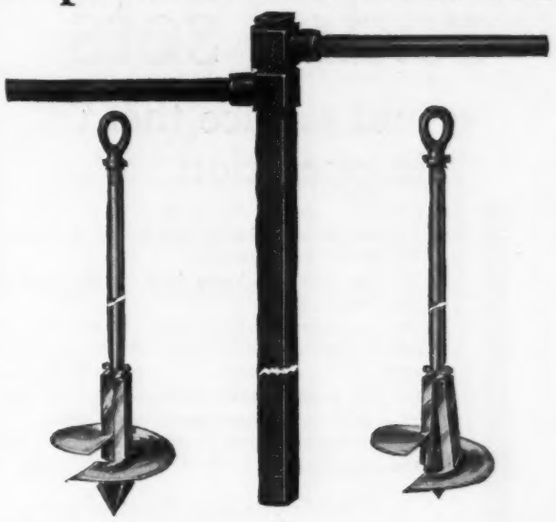

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Do you want to know how to build yourself a late model radio set?

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319 pages, 5 x 8, illustrated, $2.00

This new book gives you a practical explanation of radio construction and repair that will be valuable to you in operating your own set or in giving radio service to others.

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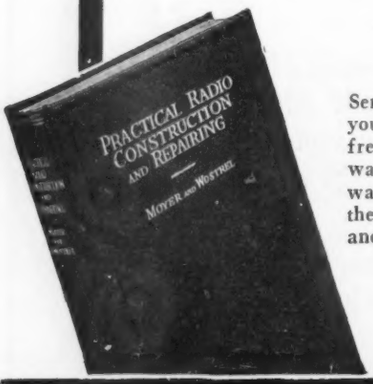

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Pattern No. 30.

The above illustration shows the plain case front of dull black devoid of distracting lettering. The extra large and wide scale opening makes the black lettering on the white background clearly visible and distant reading easy. This is one example of the careful design carried out on every part. Jewell instruments incorporate advanced features not found in other instruments.

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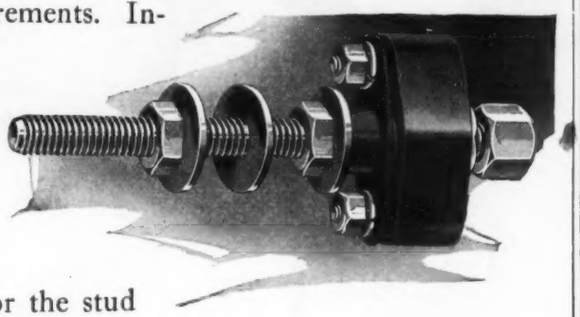
Insulation and Mechanical Strength Combine

Insulation and mechanical strength combine in the mounting studs on Jewell instruments. At the point where the stud passes through the instrument case all possibility of grounding has been overcome by the moulded design which provides insulation many times in excess of possible requirements. Insulation tests of 4,000 volts to ground conducted on the stud and instrument assembly as a whole have never produced breakdown.



In addition, the moulded asbestos binder bakelite used for the stud head provides utmost strength and makes fracture remote when pressure is applied in tightening the instrument to a switchboard.

Write for Descriptive Circular No. 1100

Jewell Electrical Instrument Co.
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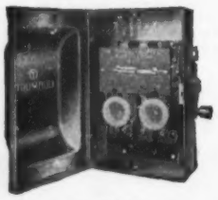

No. 93361

with overload protection by means of Inverse-Time Protective Plugs. For motors rated 5 Hp. and under 110, 220; 7½ Hp. 440 and 550 volts. Various phases. *Described in Circular 2.*

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for street lighting circuits, etc.
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Best for Switchboards

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Your Name
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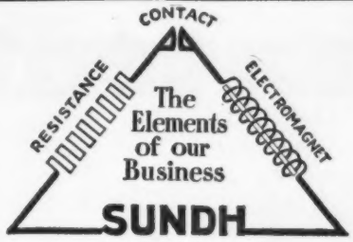

SUNDH

	Bulletin
Alarm, High and Low Liquid Level	3610-3615
Automatic Fire Pump Panels, Combined Hand and (See Panels, Fire Pump).	
Automatic Starters (See Starters, Automatic).	
Automatic Transfer Switches	5600
Brakes, Magnetic	9920
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Controllers, Elevator	9999
Elevator Controllers	9999
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Float Switches	3600-3625
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Hand Operated Switches	3600
Hand Starters (See Starters, Hand).	
High and Low Liquid Level Alarm Switches	3610-3615
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Level, High and Low Liquid, Alarm Switch	3610-3615
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Magnet Operated Valves	5700
Magnet Switches, A. C.	7500
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Magnets	6500
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Panels, Lighting, Remote Control	7100
Panels, Pressure Regulator (See Pressure Regulator, also Panels, Special).	
Panels, Special	5400-5423
Pressure Regulator, Gauge Type	4900-4902
Pressure Regulator Panels (See Panels, Special).	
Regulator, Pressure (See Pressure Regulator).	
Regulators, Speed (See Speed Regulators).	
Relay, Tumbler	7250
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Remote Controlled Speed Regulators (See Speed Regulators).	
Remote Liquid Level Indicator	3625
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Solenoids (See Magnets).	
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Starters, Hand, D. C.	8200
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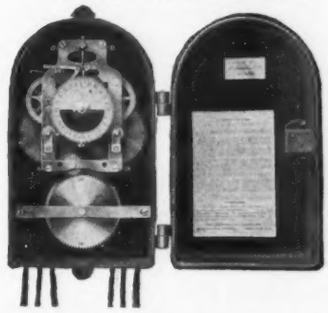
the time switch with 25 years of service behind it.



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★*A Unified Steam Generator*

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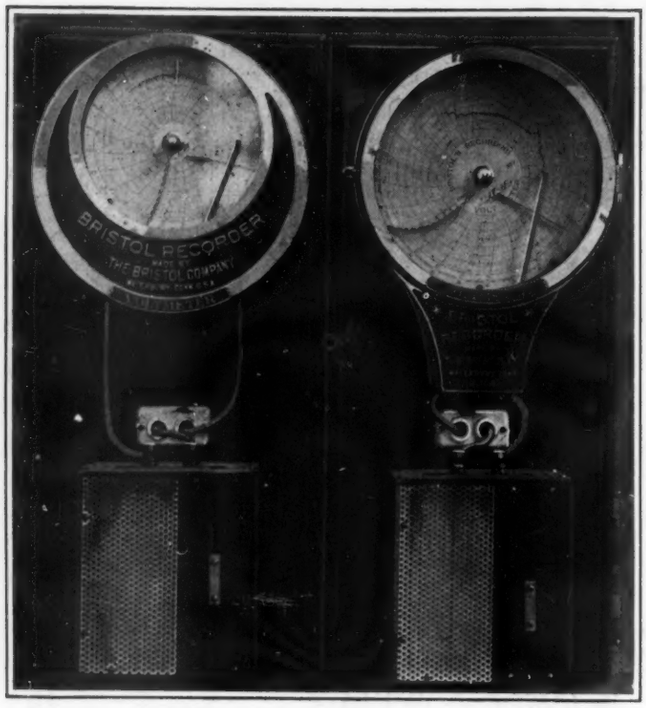
Bristol's Recording Voltmeters at Durham, N. C.



Bristol's Recording Voltmeters are silent sentinels. They watch over your lines reporting accurately and dependably every little deviation from the normal voltage.

The continuous records of voltage made by these two instruments provide the exact information necessary in maintaining steady operating loads. Just another example—one among thousands—of the confidence placed in Bristol's Recording Instruments by public utility companies.

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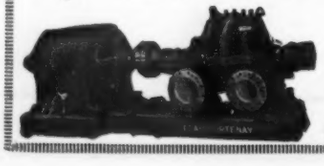

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(15)

—first cost consistent with results

To meet present day demands for higher efficiency in steam power production, it is not alone sufficient that the superheater offers uniform performance, low upkeep, safety, an economic construction, etc., as discussed in the previous articles of this series.

Each and every one of these factors are important in their way — and should not be overlooked.

In addition, however, you should know whether the first cost is consistent with the results.

Elesco superheaters are only recommended on the basis that their installation prove actually economic.

As information to executives who may not know—and as a reminder to those who may have forgotten—a series of "Be Sure" articles have been published in this space regularly.

This is the last of a series of 15 articles. Reprints of the series will be sent on request.

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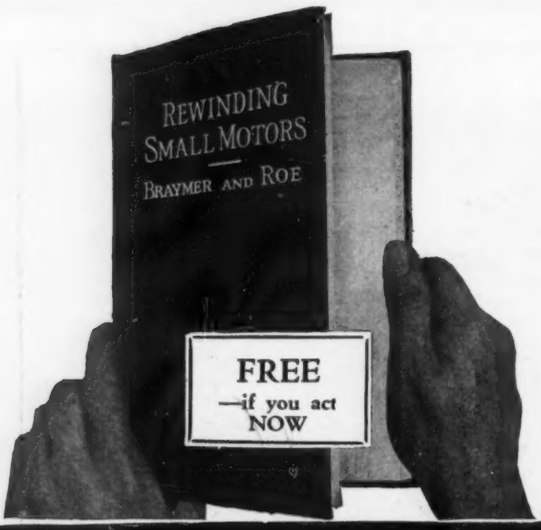

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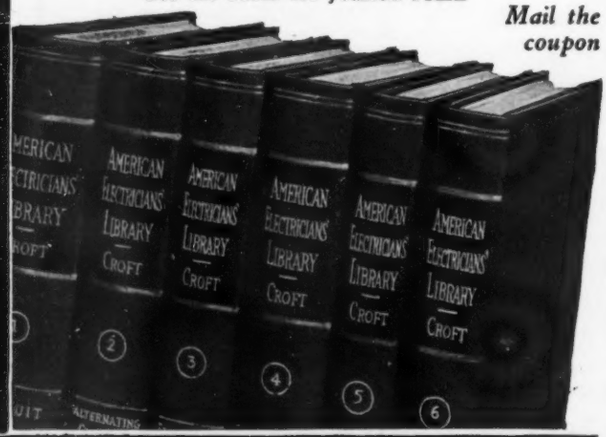

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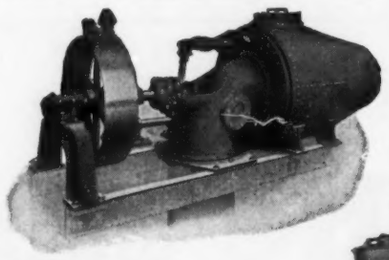

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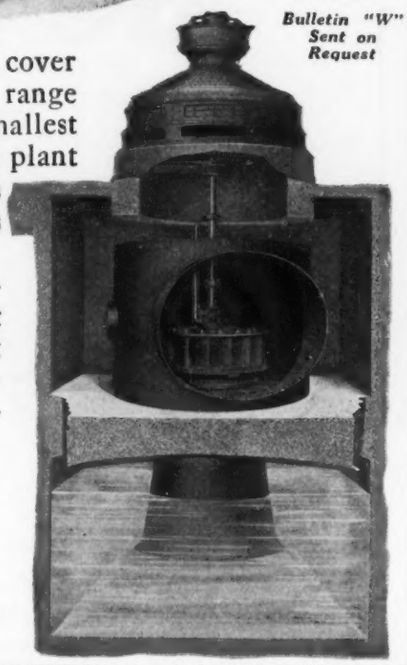

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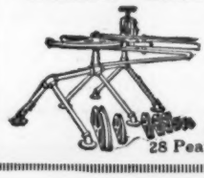

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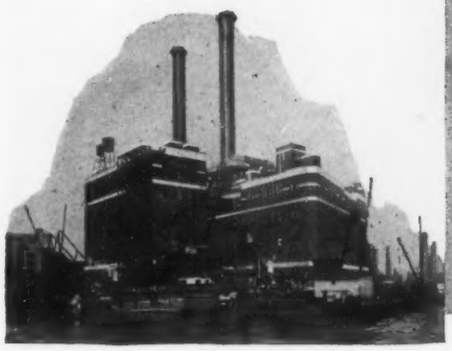

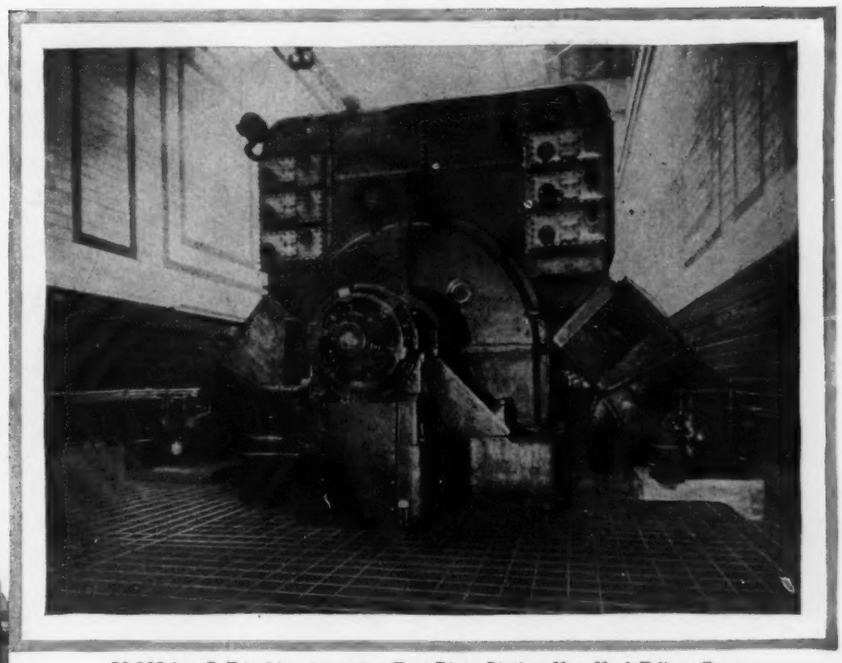

50,000-kw. G-E turbine-generator, East River Station, New York Edison Company. Surface air coolers are mounted on the generators—a suitable location where space is not available below the machine

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880-8

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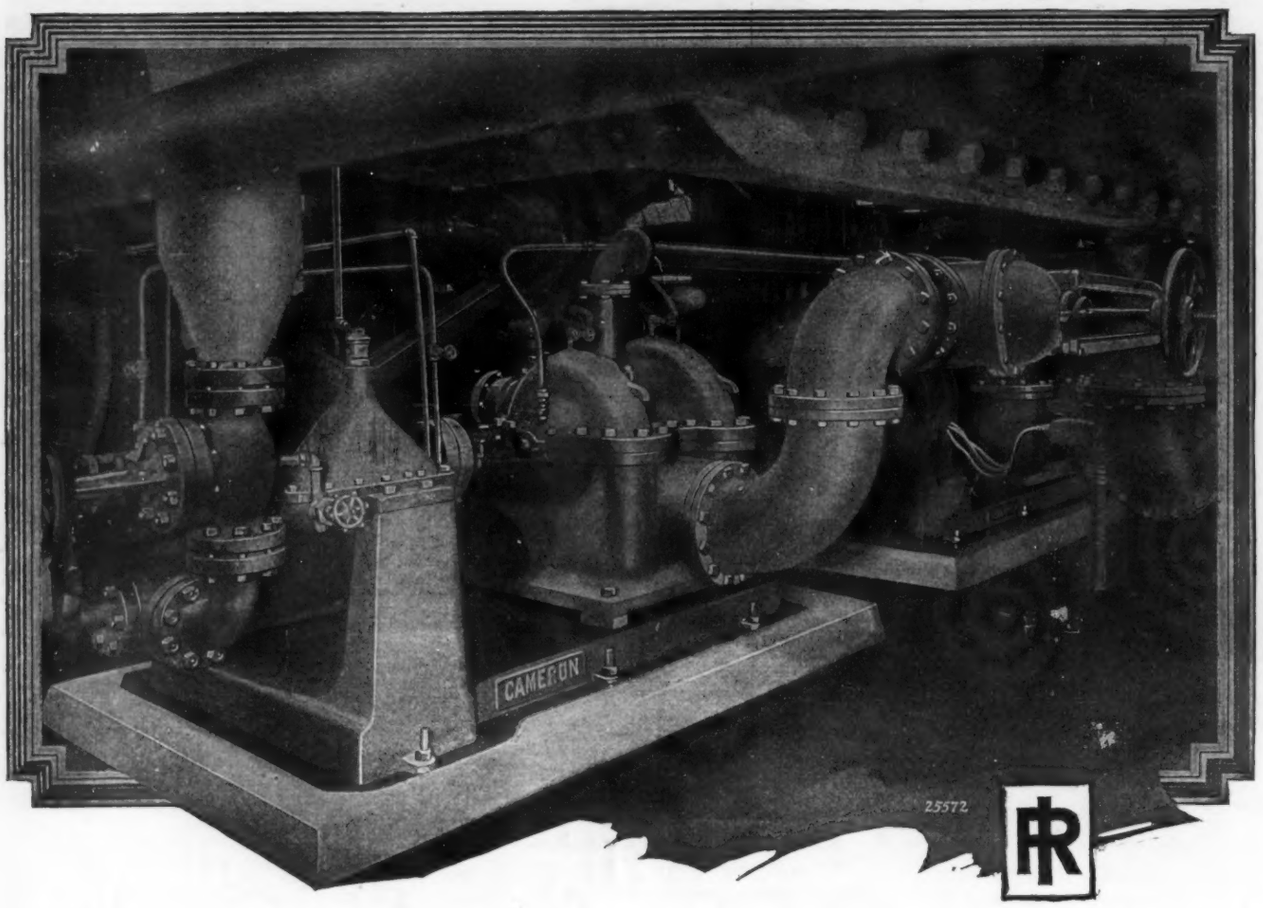

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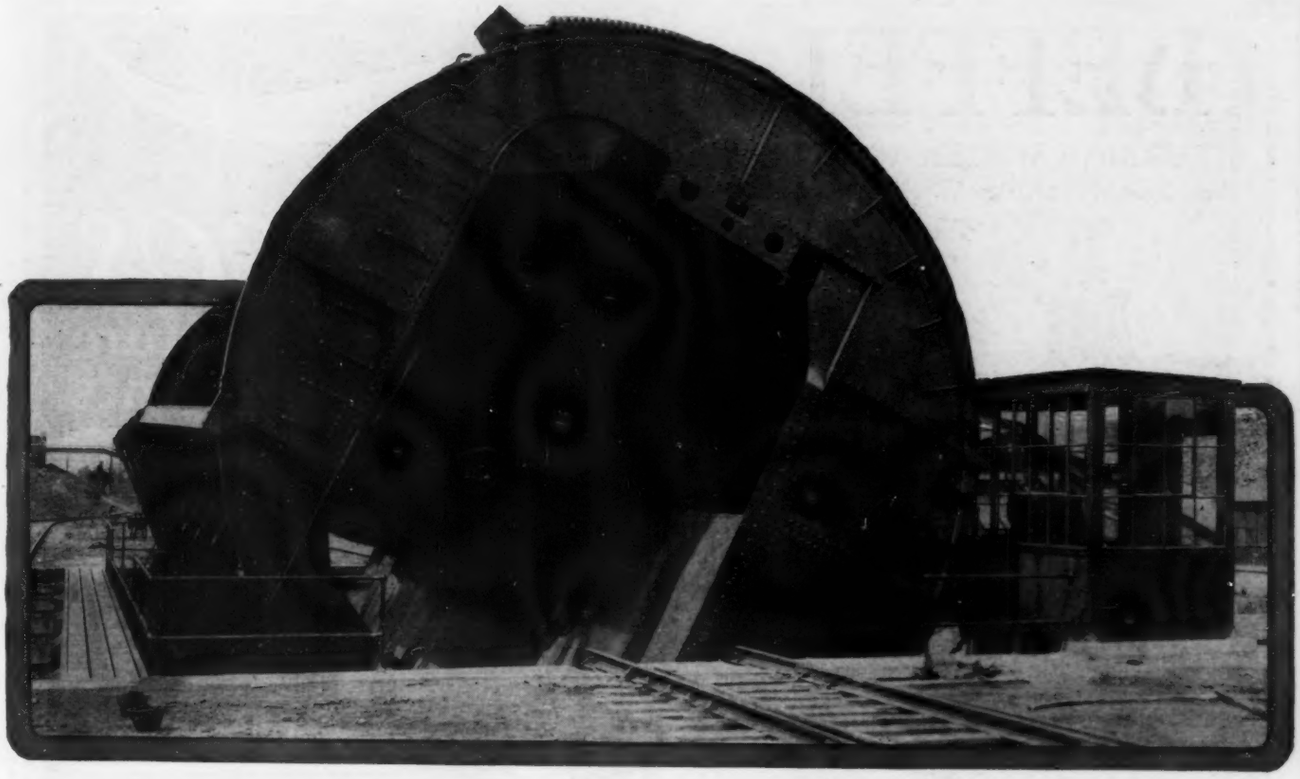

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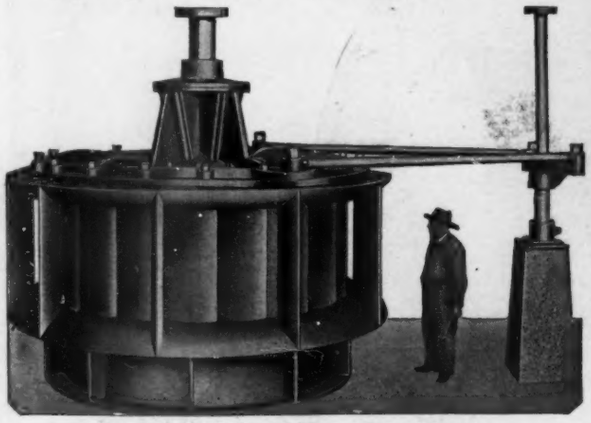

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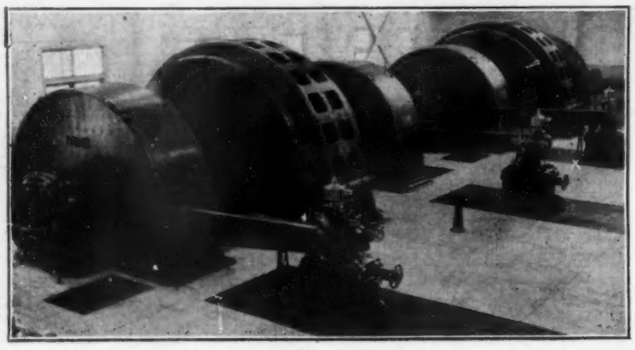

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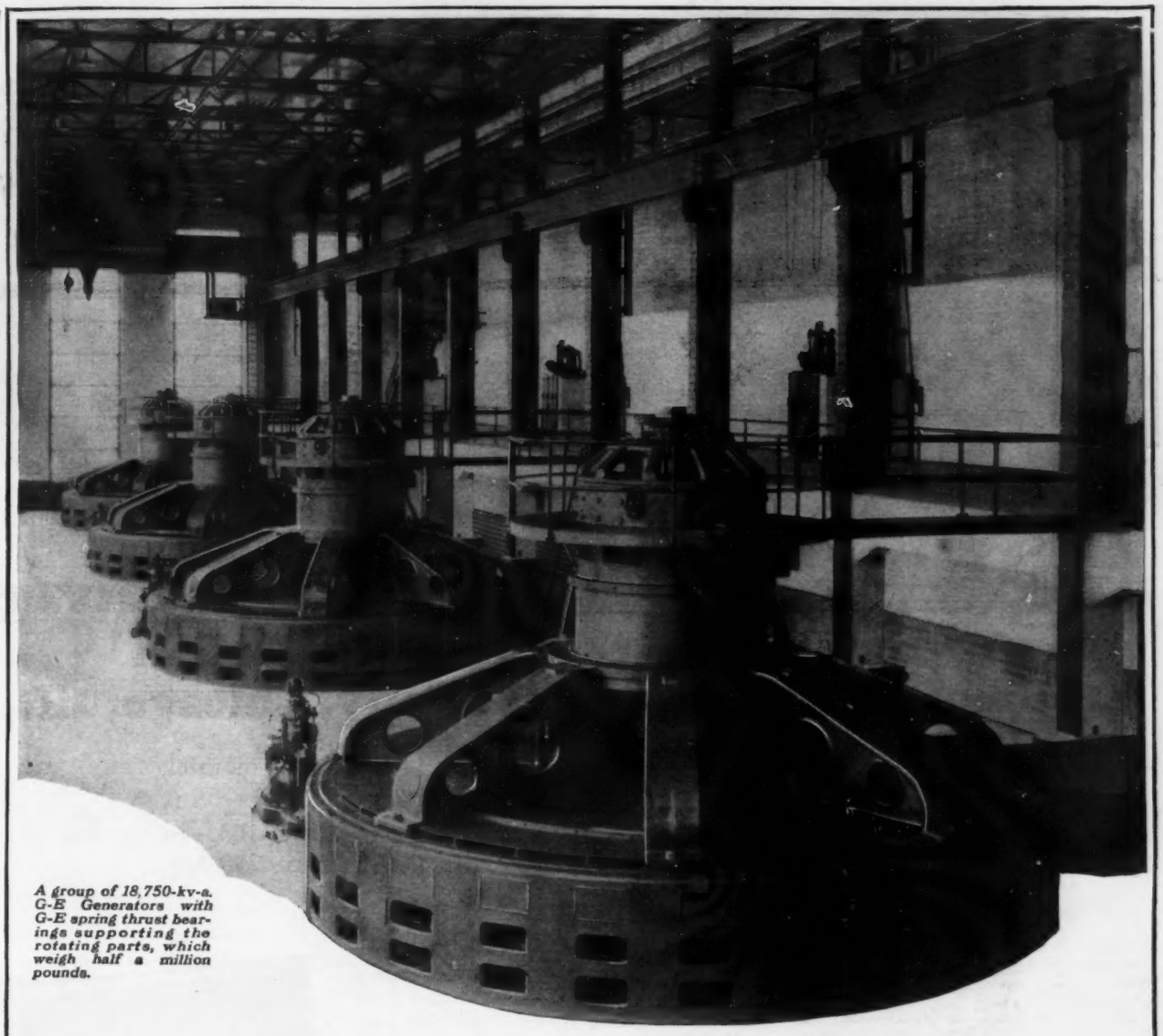

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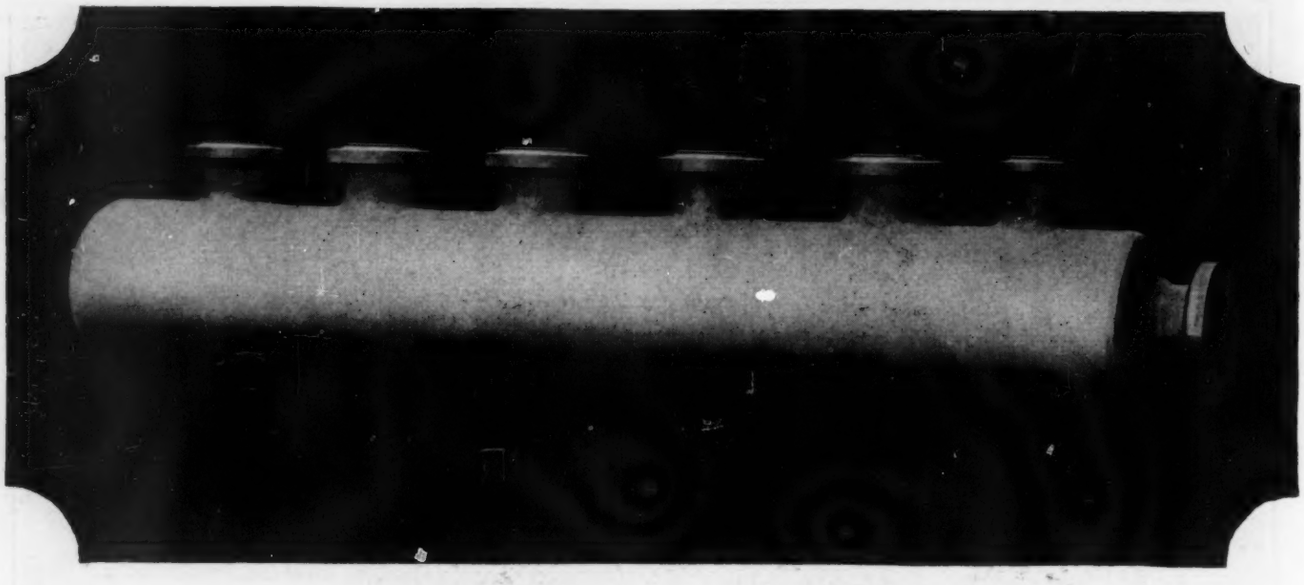

Kellogg Forge Welded Steam Receiver

for unit No. 5, Crawford Ave. Station Commonwealth Edison Company, Chicago, Ill.

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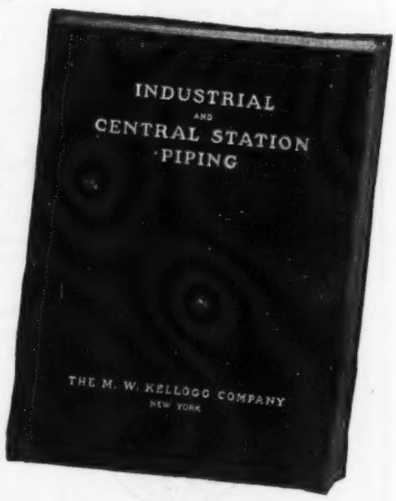

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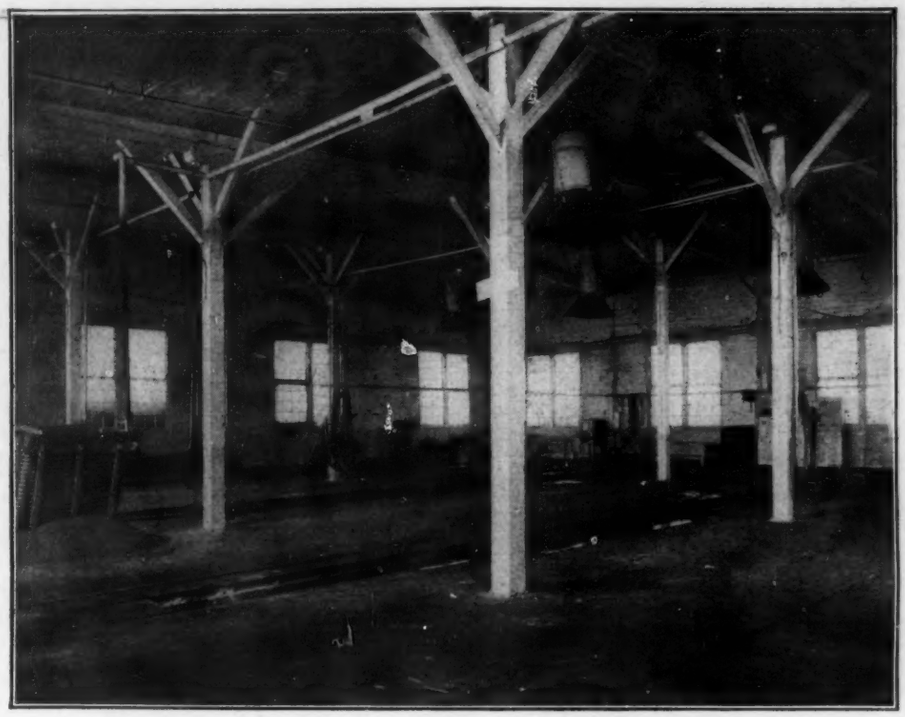

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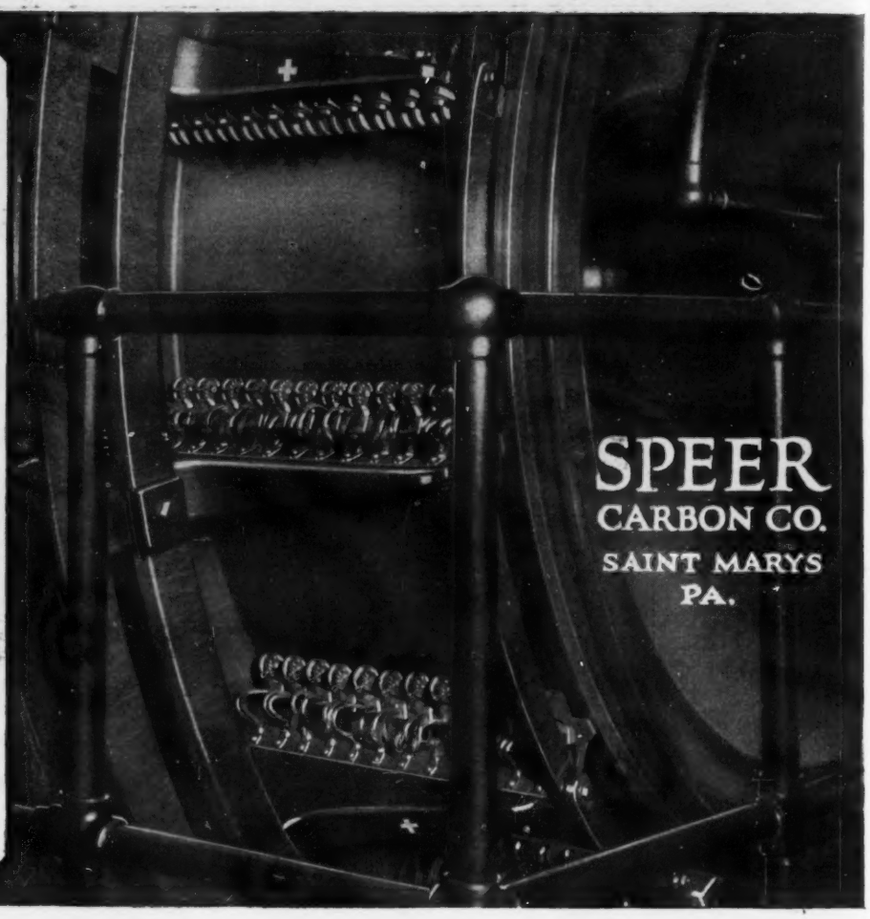

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"Fine, Pop—

at last I must agree with you.

I'm powerless to argue against perfect service. You are absolutely right that you couldn't ask for quicker acceleration and deceleration (and those two conditions occupy about 90% of an elevator's time).

That motor started smoothly and accelerated evenly and I didn't see one passenger who looked as though he'd suddenly stepped under a cold shower.

I must congratulate you, Pop, for being 99% right for once.

Your 1% slip is just this—and get it right—I've followed every detail of this installation and that elevator was motored by a Lincoln 2-Speed *Alternating Current* Motor."

(Editor's Note: This actually happened to a D.C. elevator drive enthusiast.)

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MB-4

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LINCOLN MOTOR

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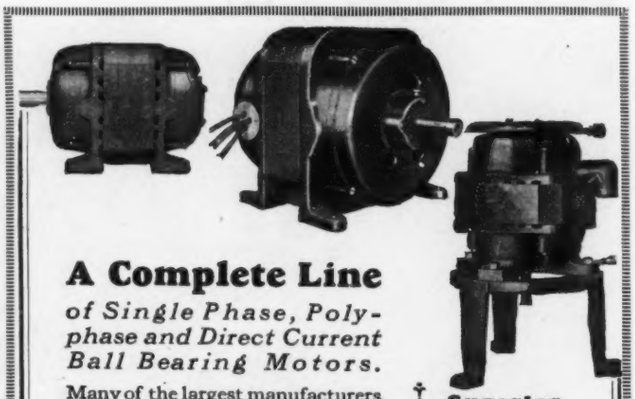

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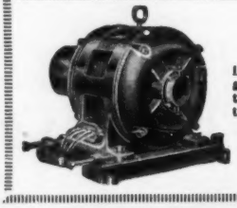

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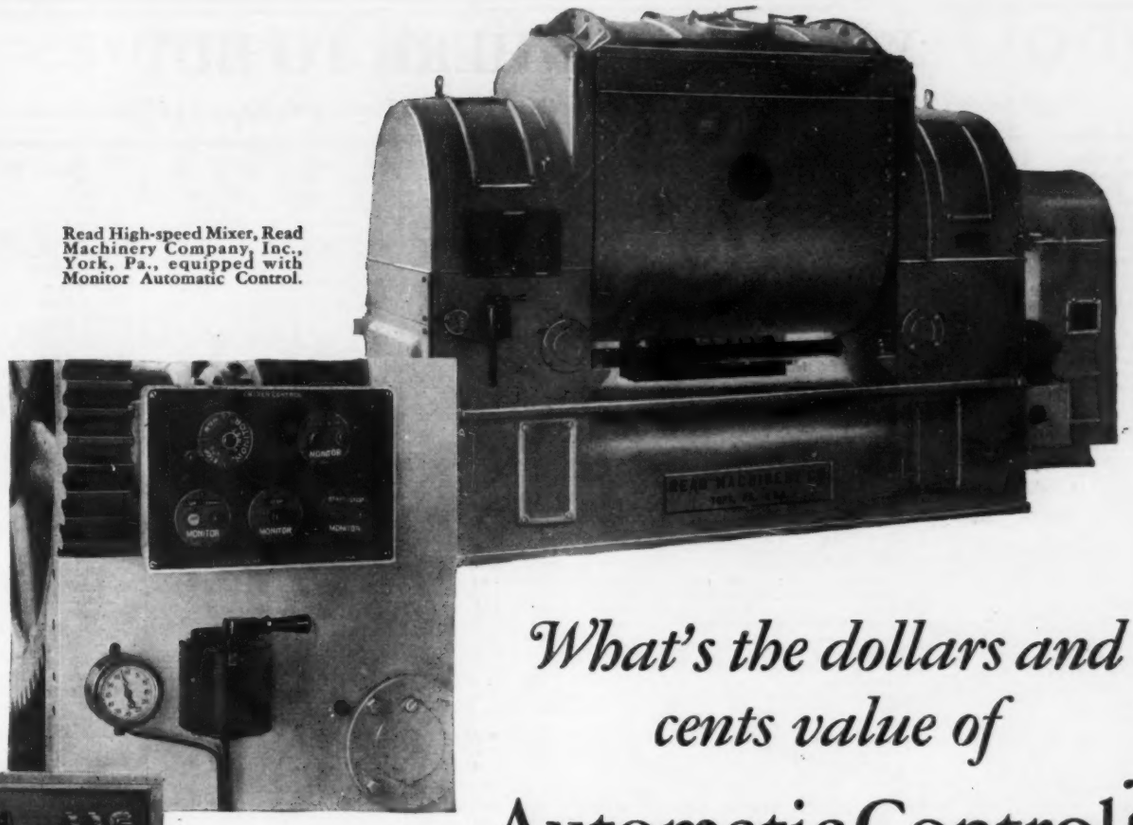
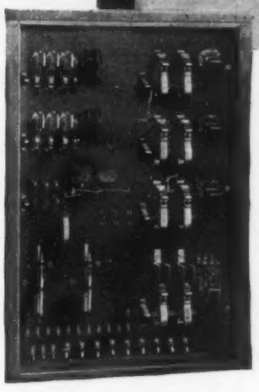
Direct and Alternating Current up to 75 hp. Also generators and alternators in horizontal and vertical types, and motor generator sets. We build motors to meet your requirements. *Ask for more data.*

Star Electric Motor Co.
Miller St. and N. J. R. R. Ave.,
Newark, N. J.

Reliance Electric & Engineering Co., 1046 Ivanhoe Rd., Cleveland, O.



Read High-speed Mixer, Read Machinery Company, Inc., York, Pa., equipped with Monitor Automatic Control.



Close-up view of Monitor Controller for Read High-speed Mixer. Note the sturdy construction of the controller elements.

What's the dollars and cents value of

Automatic Control?

HAVE you ever stopped to think what automatic control means in dollars and cents? Take this Read High-speed Dough Mixer as an example. The Monitor System of Automatic Control accomplishes the following:

1. Starts the motors "just right" and stops them "just right"—no danger of blowing fuses or straining machine or motors.
2. Automatically stops mixer after the proper time interval.
3. Provides manual adjustment of speed of agitator.
4. Power-dump control at finger tips of operator. He can "inch" the tub forward or backwards at slow speed, getting it quickly into the dumping position. No necessity of trying to "jockey" into position.
5. Machine motors and controllers fully protected at all times without necessity of having a trained electrician on duty.

The resulting saving in time and effort you can easily figure for yourself—not only for this machine but also for the machinery you may build or use.

Your problem may be much different but Monitor's standardized control elements will meet it without resort to special parts. That is one of the great advantages of Monitor Control — The Original Just Press-a-Button System.

Monitor Controller Company

Gay, Lombard and Frederick Streets, Baltimore, Maryland

New York	Buffalo	Pittsburgh	Birmingham	San Francisco	Boston
Chicago	Cincinnati	Philadelphia	New Orleans	Harrisburg	Los Angeles
	Detroit	St. Louis	Cleveland	Washington	

6532-2

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Advertised in This Issue with Names of Manufacturers

Air Heaters
Combustion Eng. Corp.
Air Washing and Conditioning Apparatus
Sturtevant Co., B. F.
Alternators
Burke Elec. Co.
Anchors, Guy
Conker Templet
Everstik Anchor Co., The
Hubbard & Co.
Kearney Corp., James R.
W. N. Matthews Corp.
Anchors, Screw Type
Kearney Corp., James R.
Apparatus, Experimental
Biddle, James G.
Apparatus, Testing
American Transformer Co.
Biddle, James G.
Armature Repair Machinery
Electric Service Supplies Co.
Arc Welders
Lincoln Electric Co.
Asbestos
Asbestos Shingle, Slate & Sheathing Co.
Johns-Manville Corp.
Babbitts
Westinghouse Elec. & Mfg. Cd.
Batteries, Dry
Western Electric Co.
Battery Charging Apparatus
Cutler-Hammer Mfg. Co.
General Electric Co.
Wagner Electric Corp.
Westinghouse Electric & Mfg. Co.
Bearings
Ball
Fafnir Bearing Co.
Thrust
S. Morgan Smith Co.
Bells, Conduit
G. & W. Electric Spec. Co.
Blocks, Fuse
Westinghouse Elec. & Mfg. Co.
Blue Printing Machinery
C. F. Pease Co., The
Boiler Room Instruments (See Instruments)
Boilers
Water Tube
Babcock & Wilcox Co.
Combustion Engr. Corp.
Bolts
Carriage
Hubbard & Co.
Crossarm
Hubbard & Co.
Expansion
Hubbard & Co.
Machine
Hubbard & Co.
Books, Technical
McGraw-Hill Book Co., Inc.
Boosters
General Electric Co.
Westinghouse Electric & Mfg. Co.
Boxes
Fuse
G & W Elec. Spec. Co.
General Electric Co.
Metropolitan Devices Co.
Schweitzer & Conrad, Inc.
Junction and Outlet
G & W Elec. Spec. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.
Meter and Service
General Electric Co.
Metropolitan Device Corp.
Braces, Crossarm
Bates Steel Corp., Walter
Hubbard & Co.
Brackets and Pins, Metal
Hubbard & Co.
Pittsburgh Transformer Co.
Brakes
Cutler-Hammer Mfg. Co.
Breakers, Reclosing Circuit
Automatic Switch Co.
Brushes, Dynamo & Carbon
Morganite Brush Co.
Brushes, Carbon
Speer Carbon Co.
Buckets, Clamshell
Blaw-Knox Co.
Link-Belt Co.
Buildings
Steel
Bates Steel Corp., Walter
Blaw-Knox Co.
Delta-Star Electric Co.
Milliken Bros. Mfg. Co.
Bus Bar Supports
Delta Star Elec. Co.
Electric Power Equip. Corp.
General Electric Co.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.
Cable (See Wires & Cables)
Cable Machinery
American Ins. Machy. Co.
Cable Boxes, Underground
G. & W. Elec. Spec. Co.
Cable Racks, End Bells and Accessories
Electrical Engineers Equip. Co.
G & W Elec. Spec Co.
Hubbard & Co.
Metropolitan Device Co
Philadelphia Elec'l & Mfg. Co.
Standard Underground Cable Co.
Sturdy Mfg. Co.
Cable Splicing Material
G. & W. Elec. Spec. Co.
Cable Taps, Solderless
Dossert & Co.
Caps, Ground
Hubbard & Co.
Cell Structures
Deceleco, Inc.
Castings, Heat Resisting
Driver-Harris Co.
Cement
High Temperature
Johns-Manville Corp.
Mitchell-Rand Mfg. Co.
Chains
Silent Power Transmission
Morse Chain Co.
Choke Coils
Hi-Voltage Equipment Co.
Chromium
General Chromium Corp.
Circuit Breakers
Condit Elec'l Mfg. Co.
General Electric Co.
Pacific Elec. Mfg. Co.
Sangamo Electric Co.
Schweitzer & Conrad, Inc.
Sundh Electric Co.
Westinghouse Elec. & Mfg. Co.
Clamps
Cable Supporting
Matthews Corp., W. N.
Ground Connection
General Electric Co.
Railway & Industrial Engr. Co.
Sherman Mfg. Co., H. B.
Westinghouse Elec. & Mfg Co.
Guy
Hubbard & Co.
Matthews Corp., W. N.
Trolley
Ohio Brass Co.
Cleats
Blake Signal & Mfg. Co.
Celeron Company
Diamond State Fibre Co.
Square D Company
Thomas & Sons Co., R.
Clevises
Hubbard & Co.
Clips, Cable
Hubbard & Co.
Clutches, Friction
Link-Belt Co.
Clutches, Magnetic
Cutler-Hammer Mfg. Co.
Coal and Ash Handling Machinery
Combustion Engineering Corp.
Link-Belt Co.
Wellman-Seaver-Morgan Co.
Coal Storage ystems
Link-Belt Co.
Coil Winding Tools
Electric Service Supplies Co.
Coils, Armature, Field and Magnet
General Electric Co.
Link-Belt Co.
Coils, Choke
Delta Star Elec. Co.
Dudlo Mfg. Co.
General Electric Co.
Hi-Voltage Equip. Co.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.
Coils, Magnet
Dudlo Mfg. Co.
Coils, Pipe
Superheater Co.
Coils, Reactance
American Transformer Co.
Coils, Transformer
Dudlo Mfg. Co.
Compensators, Starting
American Transformer Co.
Compressors, Air
Allis-Chalmers Mfg. Co.
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.
Worthington Pump & Machy. Co.
Condensers
Coil
Superheater Co.
Static
Westinghouse Elec. & Mfg. Co.
Steam
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
Worthington Pump & Machy. Co.
Conduit
Fibre
Fibre Conduit Co.
Johns-Manville Corp.
Flexible, Steel
General Electric Co.
Interior
Johns-Manville Corp.
Rigid, Aluminum
Aluminum Co. of America
Rigid, Steel
General Electric Co.
Underfloor
Fibre Conduit Co.
Underground
Johns-Manville Corp.
Connectors, Solderless
Dossert & Co.
Connectors and Terminals
Electric Power Equip. Corp.
General Electric Co.
Railway & Industrial Engr. Co.
Sherman Mfg. Co., H. B.
Sturdy Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Connectors, Solderless Service
Kearney Corp., James R.
Connectors, Transmission Cable
Sturdy Mfg. Co.
Construction Engineering (See Directory of Engineers)
Contact Points
Baker & Co., Inc.
Contact Rail Material
Electric Service Supplies Co.
Ohio Brass Co.
Control, Electric Valve
Cutler-Hammer Mfg. Co.
(Dean)
Control Railway
Ward Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.
Controllers
Electric Automatic
Cutler-Hammer Mfg. Co.
Monitor Controller Co.
Motor
Cutler-Hammer Mfg. Co.
General Electric Co.
Industrial Controller Co.
Monitor Controller Co.
Sundh Electric Co.
Union Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Converters
Allis-Chalmers Mfg. Co.
Booster
Westinghouse Elec. & Mfg. Co.
Rotary
Wagner Electric Corp.
Synchronous
Westinghouse Elec. & Mfg. Co.
Conveying Machinery (Coal, Ashes, etc.)
Link-Belt Co.
Conveyors, Belt
Link-Belt Co.
Coolers, Generator
Sturtevant Co., B. F.
Cord
Arc Lamp
Samson Cordage Works
Flexible
Indiana Rubber & Insulated Wire Co.
Simplex Wire & Cable Co.
West Virginia Pulp & Paper Co.
Portable Rubber Covered
Simplex Wire & Cable Co.
Trolley
Samson Cordage Co.
Cords and Cables, Flexible
Okonite Co.
Simplex Wire & Cable Co.
Crane Motors
General Electric Co.
Star Electric Motor Co.
Westinghouse Elec. & Mfg Co.
Cranes
Electrical
Shepard Elec. Crane & Hoist Co.
Locomotive
Link-Belt Co.
Traveling
Maris Bros.
Shepard Elec. Crane & Hoist Co.
Wellman-Seaver-Morgan Co.
Cross Arms
Hubbard & Co.
Philadelphia Elec'l & Mfg. Co.
Railway & Industrial Eng Co.
Thomas & Sons Co., R.
Western Electric Co.
Creosoted Southern Pine
International Creosoting & Constr. Co.
Steel
Bates Steel Corp., Walter
Crushers, Coal and Coke
Link-Belt Co.
Cutouts
Bowie Switch Co.
Pacific Elec. Mfg. Co.
General Electric Co.
Matthews Corp., W. N.
Metropolitan Device Corp.
Westinghouse Elec. & Mfg Co.
High Tension
Schweitzer & Conrad, Inc.
Plug
Kearney Corp., James R.
Series
G. & W. Elec. Spec. Co.
Transformers
Wagner Electric Corp.
De-Superheaters
Superheater Co.
Devices, Protective
Condit Elec'l Mfg. Corp.
Dimmers, Theatre
Cutler-Hammer Mfg. Co.
Doors for Bus and Switch Compartments
Deceleco, Inc.
Johns-Manville Corp.
Drills, Rock
Hubbard & Co.
Ingersoll-Rand Co.
Dumpers, Freight Car
Wellman-Seaver-Morgan Co.
Dynamometers
Power Specialty Co.
Economizers
Babcock & Wilcox Co.
Power Specialty Co.
Enameling Machinery, Wire
American Insulating Machinery Co.
Engineering Building and Equipment
Austin Co.
Engineers and Contractors
Stone & Webster, Inc.
Engineers, Consulting and Contracting
(See Directory of Engineers)
Engines
Diesel
Busch-Sulzer Bros. Diesel Eng. Co.
Worthington Pump & Machy. Co.
Gas
Allis-Chalmers Mfg. Co.
Worthington Pump & Machy. Co.
Oil
Ingersoll-Rand Co.
Steam
Allis-Chalmers Mfg. Co.
Equipment
High Tension
Schweitzer & Conrad, Inc.
Switching
Kearney Corp., James R.
Exchangers, Heat
Superheater Co.
Fan Motors
Century Electric Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Fans
Exhaust and Ventilating
Century Electric Co.
General Electric Co.
Wagner Electric Corp.
Westinghouse Elec. & Mfg Co.
Fault Locators
Matthews Corp., W. N.
Feed Water Heaters
Bethlehem Shipbldg. Corp., Ltd.
Fibre (See Insulating Material)
Financial
Electric Bond & Share Co.
Pynchon & Co.
Flooring, Open Steel
Blaw-Knox Co.
Furnaces
Electric
Detroit Electric Furnace Co
Pittsburgh Elec. Furnace Corp.
Electric Steel Melting
American Bridge Co.
Water Cooled
Power Specialty Co.
Furnace Walls, Water Cooled
Superheater Co.
Fuse Plugs
Delta Star Elec. Co.
Fuses
High Tension
Bowie Switch Co.
Delta Star Elec. Co.
Electrical Engineers' Equip.
General Electric Co
Co.
High Tension
Hi-Voltage Equipment Co.
Matthews Corp., W. N.
Pacific Elec. Mfg. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg Co.
Renewable
Westinghouse Elec. & Mfg Co.
Standard
Condit Elec'l Mfg. Corp.
General Electric Co.
Metropolitan Device Corp.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Galvanizing
Hubbard & Co.
Galvanizing, Hot Dip
Bates Expanded Steel Truss Co.
Bates Steel Corp., Walter
Cattie & Bros., J. P.
Lehigh Structural Steel Co.
Gates, Head and Sluice
S. Morgan Smith Co.
Gauges, Recording
Bristol Co., The
Gearing, Silent and Flexible
Link-Belt Co.
Morse Chain Co.
Gears
Continental Fibre Co.
General Electric Co.
Wellman-Seaver-Morgan Co.
Westinghouse Elec. & Mfg. Co.
Gears, Silent
Celeron Company
Diamond State Fibre Co.
Generating Sets
Direct Connected
Westinghouse Elec. & Mfg. Co.
Geared
Westinghouse Elec. & Mfg. Co.
Motor
Allis-Chalmers Mfg. Co.
Burke Electric Co.
Generating Sets (Cont')
Motor
General Electric Co.
Wagner Electric Corp.
Westinghouse Electric & Mfg. Co.
Turbine Driven
Westinghouse Elec. & Mfg. Co.
Generators
Allis-Chalmers Mfg. Co.
Belt Driven
Westinghouse Elec. & Mfg. Co.
Engine Driven
Westinghouse Elec. & Mfg. Co.
Steam
Combustion Engr. Corp.
Waterwheel Driven
Westinghouse Elec. & Mfg. Co.
Governors
Pelton Water Wheel Co.
Governors, Water Wheel
Mechanical
Woodward Governor Co.
Hydraulic
Woodward Governor Co.
Ground Caps
G. & W. Elec. Spec. Co.
Ground Rods, Galv. & Copperweld
Hubbard & Co.
Grounds, Etc.
Paragon Electric Co.
Guards, Lamp
Matthews Corp., W. N.
Hangers, Cable
Hubbard & Co.
Heaters
Feed Water
Worthington Pump & Machy. Co.
Oil
Power Specialty Co.

President G. C. Miller of Dodge *re Timken Bearings*

"Their final conclusion was that your bearing best met these requirements . . . Field experience . . . over several years has confirmed the correctness of our decision."

DODGE MANUFACTURING CORPORATION
ENGINEERS AND MANUFACTURERS
MISHAWAKA, INDIANA

EXECUTIVE OFFICE

February 7, 1927.

The Timken Roller Bearing Company,
Canton, Ohio.

Gentlemen:-

In answer to your inquiry as to why we adopted the Timken tapered roller bearing as standard in our various lines of equipment.

We had been aware of the fact that there was an increasing demand for a satisfactory low friction bearing for transmission, material handling, and general machinery.

Our engineers had been watching the development and studying the performance of the various anti-friction bearings offered for something over twenty years.

Their studies convinced them that all the better makes were satisfactory as anti-friction bearings; that they all reduced the mechanical friction to practically zero; that the slight advantages claimed first by one, then by another were actually insignificant and generally due to difference in testing set-ups for observation.

In the opinion of our engineers, nearly all the bearings had shortcomings that indicated they were not what we required in the service we had in mind.

They established as of basic importance great ruggedness in order to take care of shock and unforeseen peak loads to be met in practice, ability to take thrust loads, the practicability of securing correct mounting in volume production. They also felt that it was desirable if the manufacturer of the bearings were in such position as to control everything from the manufacture of the steel to the finished bearing. Of course, the anti-friction characteristics should be fully up to accepted practice.

Their final conclusion was that your bearing best met these requirements; that it was based on correct principle; that the quality of material and workmanship, including inspection and testing was all that could be desired.

Our field experience with many thousands of your bearings and extending over several years has confirmed the correctness of our decision.

Yours truly,

GCM-J

President

Heaters for Special Purposes
Power Specialty Co.
Heating Devices
Cutler-Hammer Mfg. Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Hoists
Electrical
Allis-Chalmers Mfg. Co.
American Engineering Co.
Link-Belt Co.
Shepard Elec. Crane & Hoist Co.
Head Gate
S. Morgan Smith Co.
Steam
Allis-Chalmers Mfg. Co.
Link-Belt Co.
Indicators, Speed (See Tachometers)
Indicators, Transformer Load
Westinghouse Elec. & Mfg. Co.
Inspections and Tests
Electrical Testing Laboratories
Instrument Transformers
General Electric Co.
Instruments
Boiler Room
Bristol Co., The
General Electric Co.
Electrical
Biddle, James G.
Bristol Co., The
Ferranti Meter & Transformer Mfg. Co., Ltd.
General Electric Co.
Jewell Electrical Instrument Co.
Sangamo Electric Co.
Graphic
Biddle, James G.
Bristol Co., The
General Electric Co.
Sangamo Electric Co.
Taylor Instrument Co.
Westinghouse Elec. & Mfg. Co.
Indicating
Jewell Electrical Instrument Co.
General Electric Co.
Taylor Instrument Co.
Westinghouse Elec. & Mfg. Co.
Integrating
General Electric Co.
Sangamo Electric Co.
Portable
Westinghouse Elec. & Mfg. Co.
Recording
Bristol Co., The
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.
Scientific and Testing Service
Biddle, James G.
Bristol Co., The
General Electric Co.
Metropolitan Device Corp.
Westinghouse Elec. & Mfg. Co.
Insulating Machinery Wire
American Ins. Machinery Co.
Insulating Material
Asbestos
Johns-Manville Corp.
Asbestos Ebony
Deceleco, Inc.
Composition Cloth & Paper
Irvington Varnish & Ins. Co.
Mica Insulator Co.
Westinghouse Elec. & Mfg. Co.
Compounds, Paints and Varnishes
Garfield Mfg. Co.
General Electric Co.
General Insulate Co.
Irvington Varnish & Ins. Co.
Mica Insulator Co.
Mitchell-Rand Mfg. Co.
Redmanol Chem. Prod. Co.
Westinghouse Elec. & Mfg. Co.
Fibre
Celeron Company
Continental Fibre Co.
Diamond State Fibre Co.
Fibre, Vulcanized
Celeron Company
Diamond State Fibre Co.
Laminated Phenolic Condensation Products
Continental Fibre Co.
Lava
American Lava Co.
Steward Mfg. Co., D. M.
Mica
Mica Insulator Co.
Munsell & Co., Eugene
Mica, Micarata
Westinghouse Elec. & Mfg. Co.
Molded
Bakelite Corp.
Celeron Company
Cutler-Hammer Mfg. Co.
Diamond State Fibre Co.
Garfield Mfg. Co.
Paper
Celeron Company
Diamond State Fibre Co.
Irvington Varnish & Ins. Co.
Paper, Fish
Celeron Company
Diamond State Fibre Co.
Porcelain
Square D Company
Silk
Irvington Varnish & Ins. Co.
Slate
Portland-Monson Slate Co.
Tape and Webbing
General Electric Co.
Mica Insulator Co.
Westinghouse Elec. & Mfg. Co.
Transite
Deceleco, Inc.
Treated Fabric and Paper
Westinghouse Elec. & Mfg. Co.
Untreated Fabric and Paper
Westinghouse Elec. & Mfg. Co.
Insulation, Electric
Bakelite Corp.
Insulation, Molded
Bakelite Corp.
Insulator Equipment
Thomas & Sons Co., R.
Insulator Pins
Hubbard & Co.
Ohio Brass Co.
Philadelphia Elec. & Mfg. Co.
Thomas & Sons, R.
Insulators
Glass
Hemingray Glass Co.
High Voltage Porcelain
Electric Service Supplies Co.
Franklin Porcelain Co.
Locke Insulator Corp.
Pin Type
Railway & Industrial Engr. Co.
Porcelain
Canadian Porcelain Co., Ltd.
Ohio Brass Co.
Porcelain Composition
General Insulate Co.
General Porcelain Co.
Lapp Insulator Co., Inc.
Thomas & Sons Co., R.
Westinghouse Elec. & Mfg. Co
Porcelain and Composition
Square D Company
Post Type
Delta Star Elec. Co.
Ironers, Electric
Savage Arms Corp.
Irons, Electric
Westinghouse Elec. & Mfg. Co.
Laboratories
Electrical Testing Laboratories
Lamps
Arc
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Incandescent
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Miniature
General Electric Co.
Lamp Guards
Matthews Corp., W. N.
Lamp Replacers
Matthews Corp., W. N.
Lighting Equipment and Accessories
Hubbard & Co.
Lighting Equipment, Interior and Exterior
Westinghouse Elec. & Mfg. Co.
Lighting Fixtures, Industrial
Philadelphia Elec'l & Mfg. Co.
Lighting Standards
Bates Steel Corp., Walter
Philadelphia Elec'l & Mfg. Co.
Truscon Steel Co.
Lightning Arresters
Delta Star Elec. Co.
Electric Power Equip. Corp.
Electric Service Supplies Co.
Electrical Engineers' Equip. Co.
General Electric Co.
Hi-Voltage Equipment Co.
Hubbard & Co.
Pacific Elec. Mfg. Co.
Railway & Indus. Engr. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.
Line Material
Electric Service Supplies Co.
G & W Elec. Spec. Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.
Lineman's Safety Platform
Crescent Tool Co., The
Hubbard & Co.
Linemen Protector Co.
Linemen's Supplies & Tools
Crescent Tool Co., The
Locaters, Fault
Matthews Corp., W. N.
Locomotives, Electric
Westinghouse Elec. & Mfg. Co.
Lumber, Creosoted Southern Pine
International Creosoting & Constr. Co.
Machines
Mining
Allis-Chalmers Mfg. Co.
Pipe Bending
American Pipe Bending Machine Co.
Welding
Westinghouse Elec. & Mfg. Co.
Magnets
Dudlo Mfg. Co.
Meters
Demand
Landis & Kyr, Ltd.
Westinghouse Elec. & Mfg. Co.
Kilovoltamperes
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.
Watthour
Duncan Elec. Mfg. Co.
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.
Meter Testers
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Meters, Electric & Flow (See Instruments, Electric & Boiler Room)
Mica
Mica Insulator Co.
Munsell & Co., Eugene
Molded Insulation (See Insulation, Molded)
Molded Parts
Garfield Mfg. Co.
Molding Materials
Bakelite Corp.
Motor Generators
Westinghouse Elec. & Mfg. Co.
Motors
Allis-Chalmers Mfg. Co.
Baldor Electric Co.
Burke Elec. Co.
Century Electric Co.
General Electric Co.
Lincoln Electric Co.
Marble Card Elec. Co., The
Reliance Elec. & Eng. Co.
Sturtevant Co., B. F.
Wagner Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Zobell Elec. Motors Co.
Mine
Westinghouse Elec. & Mfg. Co.
Railway
Westinghouse Elec. & Mfg. Co.
Small
Westinghouse Elec. & Mfg. Co.

Oil Burners
Babcock & Wilcox Co
Oil Engines (See Engines)
Oil Separators and Purifiers
De Laval Separator Co.
Hydroil Sales Corp.
Packing
General Electric Co.
Painting Equipment, Mechanical or Electrical
Matthews Corp., W. N.
Paints, Aluminum
Aluminum Co. of America
Panel Boards
General Electric Co.
Trumbull Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Panels, Switchboard
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Pavement Breakers, Pneumatic
Ingersoll-Rand Co.
Pencils, Drafting
American Lead Pencil Co.
Penstocks
Kellogg Co., M. W.
Piling, Creosoted Southern Pine
International Creosoting & Constr. Co.
Pins, Insulator
Hubbard & Co.
Pipe
Riveted Steel
Riter-Conley Co.
Pipe Frame Fittings, Electrical
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.
Platinum
Baker & Co., Inc.
Plug Cutouts, Expulsion Porcelain Type
Kearney Corp., James R.
Plugs, Attachment
General Electric Co.
Plugs, Attachment and Caps
Cutler-Hammer Mfg. Co
Pole Line Hardware
Electric Service Supplies Co.
Hubbard & Co.
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Poles, Reinforcing of
Hubbard & Co.
Poles
Cedar
Bell Lumber Co.
Western Electric Co.
Weyerhaeuser Sales Co.
Chestnut
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Creosoted Southern Pine
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Bates Expanded Steel Truss Co.
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Lehigh Structural Steel Co.
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Babcock & Wilcox Co.
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Combustion Engineering Corp.
Power Spec. Co.
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Worthington Pump & Machy. Co.
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Rheostats
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Rods, Brass, Copper & Bronze
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Stewart & Co., Paul
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Sockets and Receptacles
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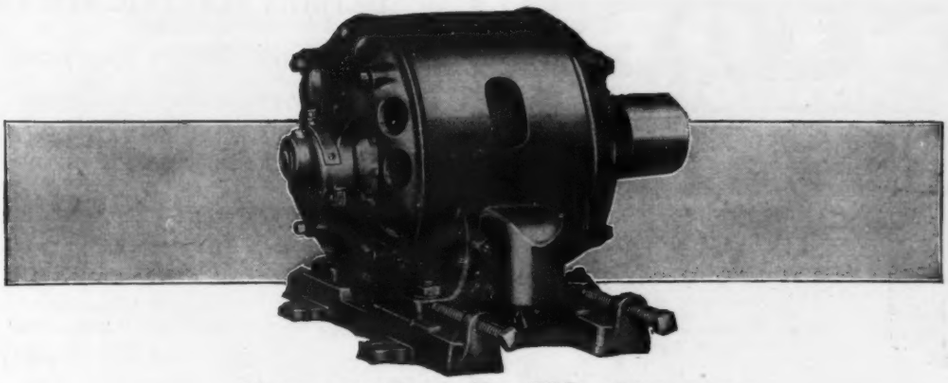

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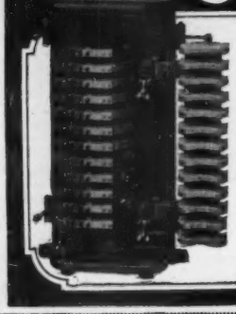

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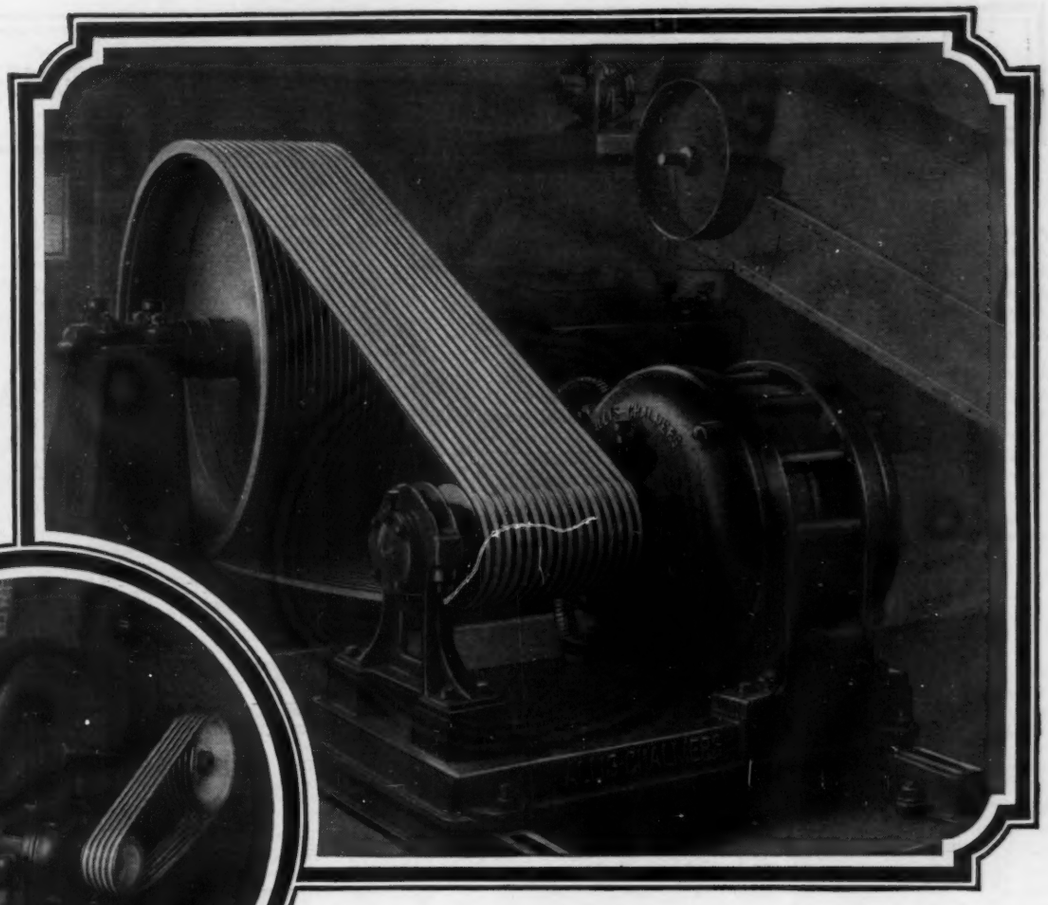
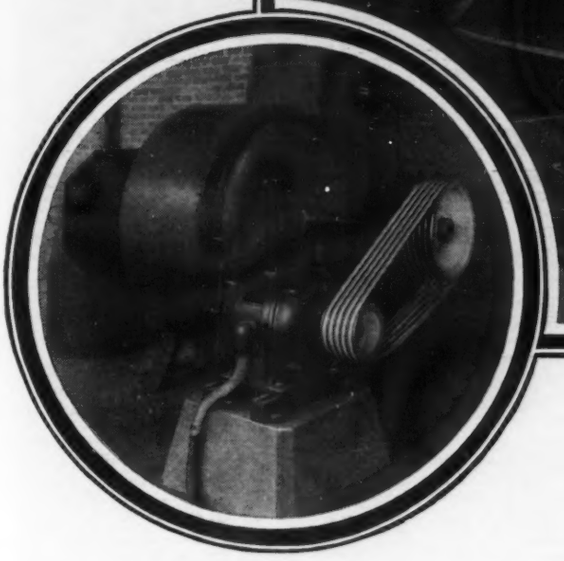


75 hp., three bearing Roller Bearing Motor driving Auger Machine through Texrope Drive.

25 hp., 1,750 r.p.m. Roller Bearing Motor operating "Sirocco" Draft Fan through Texrope Drive.



In a Clay Products Plant

The Michigan Clay Products Company in this model plant has adopted individual drive throughout. Allis-Chalmers Timken equipped Roller Bearing Motors are used exclusively, their rugged construction with steel frames and thorough insulation are outstanding advantages, while with roller bearings, greasing is required only at long intervals.

The Texrope Drive with its short centers permits better arrangement of the machinery than would be possible with belts and allows higher speed motors than for direct connection and also gives greater flexibility.

Write for descriptive bulletins.

Why Roller Bearing Motors?

These motor bearings are dust proof.
Roller Bearings minimize friction and require only infrequent greasing.
Roller Bearings maintain permanent motor air gap.

Why the Texrope Drive?

It is compact, permitting driven machines to be located most efficiently in relation to each other.
It is positive and silent.
Dust does not affect it.
It requires no lubrication.
In addition to these advantages, economy is high and maintenance low.

ALLIS-CHALMERS
MILWAUKEE, WIS. U.S.A.

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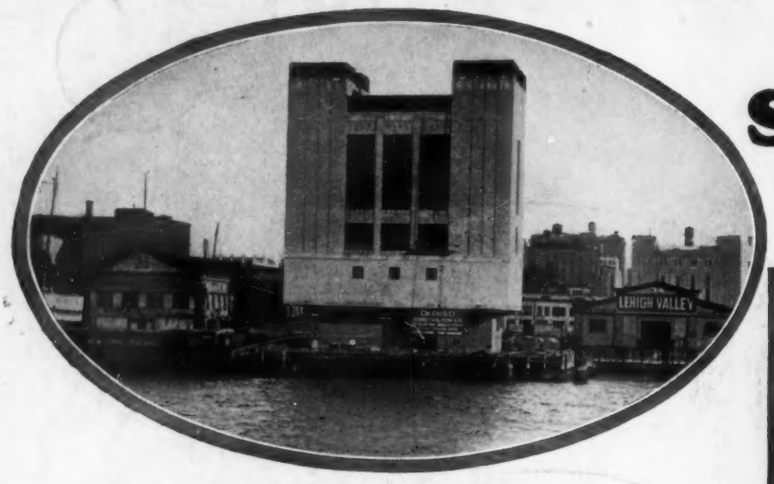
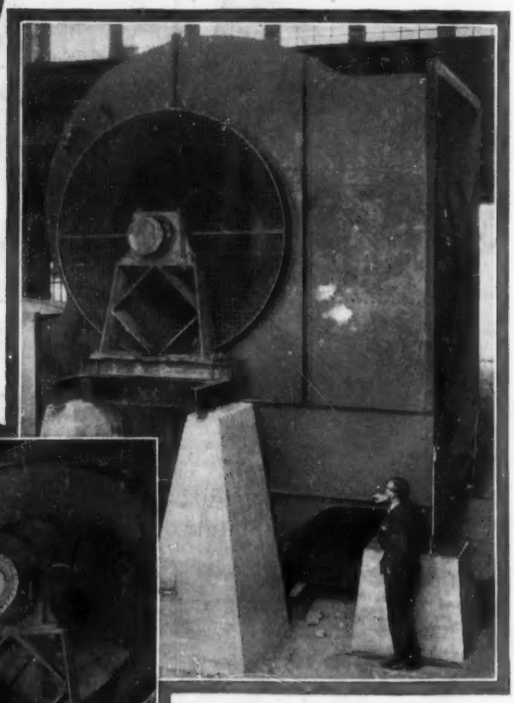
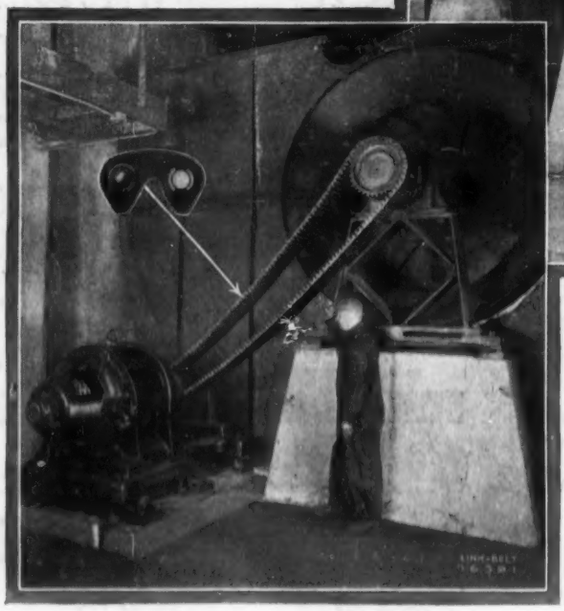
Holland Tunnel Relies on Link-Belt Silent Chain Drives



Continous Performance demanded of 84 Drives on Holland Tunnel Fans

EIGHTY-FOUR huge fans, supplying 3,761,000 cubic feet of air per minute, will keep the air in the new Holland Tunnel safe for the thousands of persons who will use this new vehicular highway. This installation will be required to operate 24 hours per day, every day in the year, and 50% of the time at maximum load. It is significant that Link-Belt Silent Chain Drives will be relied upon to maintain this vital service.





Upper left: Exterior view of the Ventilation Building on the Manhattan side.
Upper right: One of the huge fans in place.
Center: One of the drives with casing removed.

Link-Belt Silent Chain Drives on the Holland Tunnel fans range from 14 to 179 H. P., and total 6,333 H. P. They are built in sizes from ¼ to 1000 H. P. and over. Send for a copy of our Link-Belt Silent Chain Drive Data Book No. 125

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